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THE JOURNAL
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THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A PRELIMINARY STUDY OF THE INHERITANCE OF ARITHMETICAL ABILITIES¹

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I. STATEMENT OF THE PROBLEM

The aim of this paper is to set forth a method which seems to make possible a quantitative treatment of mental inheritance. The method has been tested in a study of the resemblance of child to parent in arithmetical constitution, that is, in the relations between the degrees of skill he shows in the simple arithmetical processes. The measurements made show that if, for instance, a child is much quicker than the average in subtraction, but not in addition, multiplication or division, it is to be expected that one at least of his parents shows a like trait; or, if he falls below the average in subtraction and multiplication, and exceeds it in addition and division, again the same will hold true of at

¹ This study was made under the supervision of Dr. Charles Zeleny, of the Department of Zoölogy, University of Illinois, whose criticism and suggestion were an indispensable aid. Acknowledgement is also due the cordial coöperation of the Department of Education of that university.

least one of his parents. The probability that this likeness is due to the organic continuity between parent and child is somewhat discussed. The report is based upon the results of a preliminary investigation begun in the fall of 1912 at the University of Illinois, where the coöperation of the Departments of Zoölogy and of Education gave unusual advantages for carrying on the work. It was found possible to test the theory by actual measurements of families, and to obtain a provisional measure of the degree of resemblance in families, which is significantly high; this may prove to be a hereditary likeness.

II. METHOD

The measurements were made by means of the Courtis Standard Tests in Arithmetic.²

In the work of measuring families, the tests were given almost as Mr. Courtis describes them and scored in terms of speed only as he recommends. The results of the first five only are here given.³ Each was repeated before going on to the next, in order to lessen the effects of chance; and the average of the two trials was taken as the score. Directions to each group were made as brief, as simple and as nearly uniform as possible. To this end the same person gave them all, explaining merely that the object of the test was to learn each person's comparative speed in the different kinds of examples, and pointing out how this made it necessary to do each as fast as he could. I tried to have each group, and each member of a group, take the test in the same spirit, but differences in temperament made this well-

² These tests, the work of Mr. S. A. Courtis, Detroit, Michigan, were devised to measure the ease and accuracy with which pupils in the grammar grades could handle two-figure combinations in addition, subtraction, multiplication and division, and a variety of simple problems in arithmetic. The eight tests are described and illustrated in Mr. Courtis' recent report (Courtis 1913) to the Committee on School Inquiry of the New York Board of Estimate and Apportionment, on the Courtis Tests in Arithmetic which he had just carried out in that city. The first five, those from which these data are drawn, are as follows:

Test No. 1.	Speed Test—Addition	} Combinations 0-9
“ “ 2.	“ “ —Subtraction	
“ “ 3.	“ “ —Multiplication	
“ “ 4.	“ “ —Division	
“ “ 5.	“ “ —Copying Figures (Rate of motor activity)	

Mr. Courtis describes the tests from an educational point of view, but his account brings out their accuracy, and their fitness for the work of comparing abilities in the same individual, and individuals with one another.

The three longer and more complex tests were given at the same time; their results are less easy to interpret and will be left to a later paper.

nigh impossible. This, however, is a factor which presumably affects the tests as a whole and not relative excellence in any two tests. The resemblances found cannot be due to the fact that all the members of a family were tested at the same time, for it was found (1) that an unrelated person tested with a family does not show the resemblance, and (2) that a group of unrelated persons tested together does not show resemblance among its members. Such unrelated groups show the same random resemblance, or lack of it, as appears in the general population. (See Fig. III.)

Between each two tests there was an interval of two or three minutes, during which each subject was asked to count his answers and mark the score on the sheet itself and on the record sheet he had already filled out with his name, sex, age, and the date and time of the test. These counts were later verified; at this time they served three purposes: (1) they added interest to the tests; (2) they took up the time of relaxation between the tests; (3) they made a single rechecking sufficient.

Minor variable factors, such as time of day, physical and mental condition, distraction, discomfort, seem to have caused what differences were found when the same person was tested at different times. These were not enough to change materially the direction of the curve. Figure I shows the curves of a person tested four times, at nine-day intervals. Any constant factors whose presence was not detected and allowed for must have in all probability affected the scores in all five tests alike which would change the individual curve in position rather than in shape. The presence of constant sources of error may be one reason why children and parents are more alike in the relations they show between the various abilities than in absolute standing in any one ability.

What differences may be due to age are unknown, so no steps could be taken to eliminate them. It seems probable that there may be a slowing down of all processes after maturity is passed; in this case there need be no change in the shape of the curve. In face of the close likeness between parent and child this conclusion is almost forced upon us.

No sex differences have been noted. This accords with Mr. Courtis' observations on thousands of cases. Moreover, a child of either sex may resemble either parent; and all the children of the same family do not always resemble the same parent.

III. SUBJECTS

Few families are both willing and able to give an hour or an hour and a half of their concerted time to the taking of these tests. A beginning was made by sending a circular letter to eighty members of the faculty of the University of Illinois, inquiring as to their willingness to take part in the tests. From the twelve families who replied favorably, and almost as many others learned of from these, records have been gathered. On eight of these families—all, in fact, in which the children were over fourteen years and therefore comparable, this preliminary report is based. To make possible the comparison of these records, however, it was necessary to know the average adult scores for the class of people under consideration. To this end several university classes, in education and zoölogy, were through the coöperation of Dr. Bagley and Dr. Zeleny submitted to the tests, as was a volunteer group of graduate students in science. It will be noticed that all the work has been done among a highly educated class of people. It seemed most feasible, and also advisable, that the problem should be thus limited at first, in order that the results of the preliminary work should have as definite a meaning as might be. All the averages, therefore, and exact numerical statements will be understood to apply merely to this class.

IV. THE RECORDS

The records from which conclusions are here drawn are the score sheets of two hundred unrelated adults, and of the eight families including twenty individuals (See Appendix I). Each score sheet gives the score in each of the two trials of each test, with the average of the two. In two families four trials on different days were made, in the hope of increasing the accuracy. These were in one case at four-day, in the other at nine-day intervals, that the effect of practise might be kept down (See Figure I). Seven individuals also who had taken the tests in the ordinary way were tested a second time after an interval of weeks, and one a third time; as the second and third curves were similar in form to the first, the chance errors in making the tests in this way may probably be neglected. Were the correlation perfect, every chance error in testing must reduce it; hence where the obtained correlation is high it may safely be said the correlation must be still higher.

V. TREATMENT OF RECORDS

Very early in the work, as has been said, the need for an adult average was felt. To meet this, as many adults as possible were tested during the year, and from the two hundred records obtained the averages used in calculation were computed (see Table I). From these and the standard deviation (ϕ) in each operation a graph sheet has been arranged which seems suitable

TABLE I.

Average and Standard Deviation for each Operation

	Average no. of examples per minute	ϕ = Standard Deviation
Addition.....	73 (74)*	15
Subtraction.....	60 (64)	14
Multiplication.....	53 (52)	11
Division.....	58 (55)	14
Copying Figures.....	124 (135)	17

* The numbers in parenthesis are the averages found by B. T. Baldwin at Swarthmore College, and are inserted here for comparison. (See *School and Society*, 1: 1915, 569-576.)

for use with individuals over fourteen years (see Figure II). The average for each operation forms the zero point of the scale, above or below which every individual falls; these zero points are placed one below another down the middle of the sheet. The standard deviation is taken as the unit distance above and below zero. Thus a person whose score in addition is above the average by two and one-tenth times the standard deviation stands at 2.1 on the line representing addition.

In the numerical handling of the records, also, individual standing has been expressed in terms of the standard-deviation unit; that is, as being so many times the standard deviation, above or below the average. For instance, suppose a score in addition is 82 examples done in one minute. This is nine more than the average. Since the standard deviation is 15, this score would become +0.67, or almost seven-tenths of a unit above the average. Or, a score represented as +1.70 would be interpreted thus: since 1.70 means above the average by 1.70 times the standard deviation, which is 14, this score is 25.5 above the average (73). This means an actual accomplishment of 98.5 examples in one minute.

This method of expression was chosen in order to bring all the operations to the same terms, that different operations might

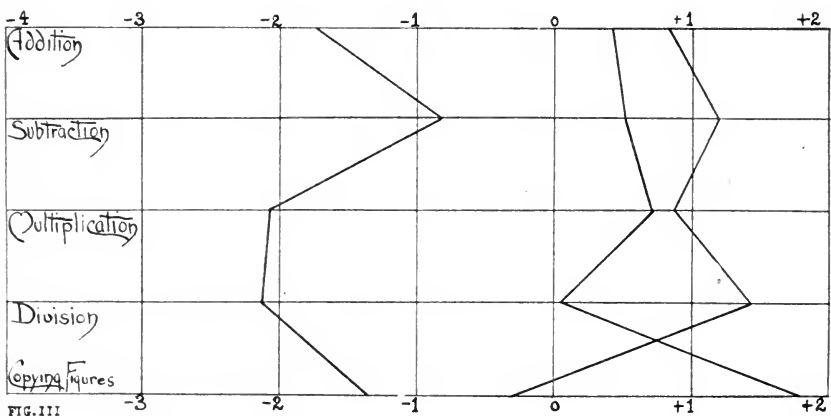
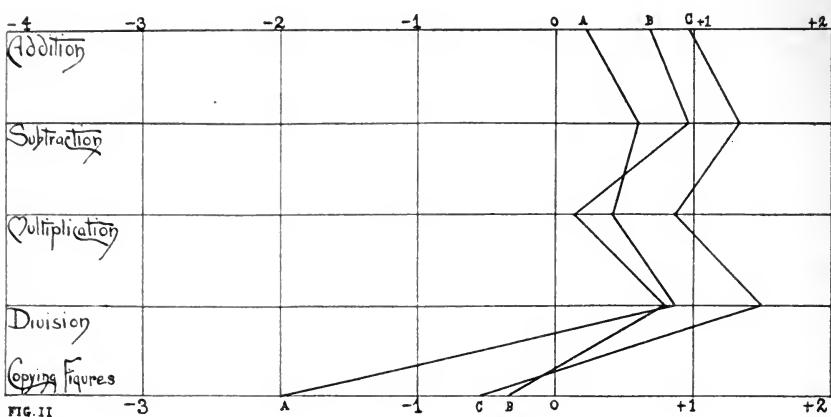
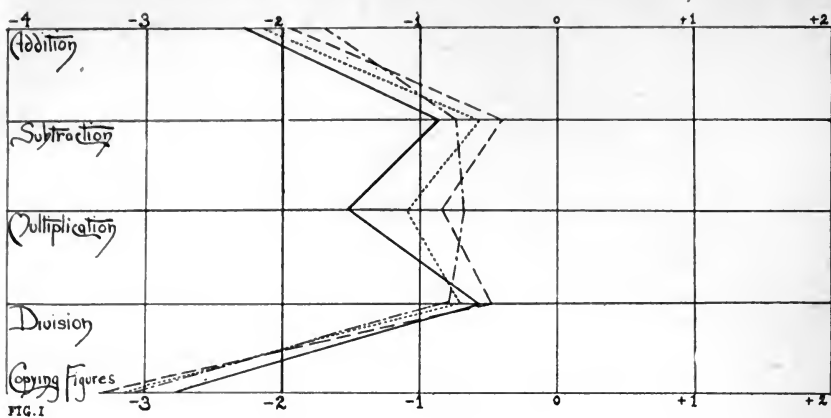


Figure I. Curves of One Person Tested at Four Times.

1st test
 2nd test
 3rd test
 4th test

Figure II. Curves of Parent (A) and Two Children (B & C.)

Figure III. Three Unrelated Curves.

be directly compared. If, for instance, my score in addition when transmuted to standard deviation units is $+0.55$, and in subtraction $+0.86$, the relation between them may then be expressed as $+0.31$; that is, to move from the addition standing to the subtraction standing is to move in the positive direction through .31 of the standard deviation unit, which is made the same size in each case. A glance at Figure II, curve B, will make this clear. Further, if the multiplication score is $+0.03$, the division $+0.63$, and copying figures -0.50 , the subtraction—multiplication relation is -0.83 , the multiplication—division relation $+0.60$, and that between division and copying figures -1.13 . (See Table II and Figure II, Curve B.) It is relations such as these which have been compared in parent and child.

My mother's scores, for example, though differing in *absolute* value from mine, still bear to one another the *relations* shown in Table II (first two columns) and Figure II, Curves A and B;

TABLE II.

<i>Relations Between Operations in Mother and Daughters</i>			
Relations	Mother	1st Daughter	2nd Daughter
Add.—Sub.....	$+0.35$	$+0.31$	$+0.36$
Sub.—Mul.....	-0.10	-0.83	-0.44
Mul.—Div.....	$+0.36$	$+0.60$	$+0.57$
Div.—c. f.	-2.91	-1.13	-2.08

hence there is evidently some degree of correspondence, while with the figures given for a younger daughter the correspondence is even closer (see Table II, first and third columns, and Figure II, Curves A and C). Figure III shows the curves of three unrelated persons. In calculating the coefficients of correlation, not only these successive relations, but also the relations between addition and multiplication, addition and division, subtraction and division, and between each of these and copying figures, have been used. The degree of correspondence has been worked out by the Pearson product-moments method.

VI. RESULTS

Before giving the results of the work, I wish to bring up once again the point, that the correlation between the *actual scores* of child and parent in a *given operation* is not the subject of this paper. That such a correlation exists, the curves bear witness; and some attention has been given to it. A child whose parents make high scores is more likely than not to make high scores himself. The correlations for this relation are given in Table III. (See also Figures IV and V.)

TABLE III.

Coefficient of Correlation Between Absolute Scores of Child and Parent

	Child and Mid-parental standing	Child and Like Parent	Child and Unlike Parent
Addition.....	+0.28	+0.54	+0.05
Subtraction.....	+0.01	+0.27	-0.11
Multiplication.....	+0.55	+0.79	+0.24
Division.....	+0.31	+0.44	+0.08
Copying Figures....	+0.45	+0.65	+0.13
Average.....	+0.32	+0.54	+0.08

But attention has been given primarily to the fact that a child whose parents make better scores in subtraction than in addition is likely himself to make better scores in subtraction than in addition; here the coefficient of correlation with that one of the parents whom the child more resembles is +0.71 (see Tables IV and V). In terms of the graph, it is likeness in form, not in position, between the curves of parent and child with which we are chiefly concerned (see Figure II).

An instructive way to get the significance of the correlations which show themselves between parent and offspring from this treatment of the data is to ask ourselves what the figures would be, under stated conditions; and to use these as a basis of comparison. Three hypotheses are possible: (1) there is no resemblance between these traits in child and in parent; (2) there is resemblance due to the action of heredity; (3) there is resemblance due to the action of environment.

(1) If a child showed no tendency to do better in the operations in which his parent did better, than in other operations, the following statements should hold true:

TABLE IV.

Coefficients of Correlation, Actual and Hypothetical

With	Child's Coefficient of Correlation				Actual Figures
	With no re- semblance	With resemblance due to			
		Inheritance and perfect Blending	Inheritance and Segregation		
Midparental standing..	0.00	Approach- ing +1.00	Over +0.50		+0.49
More like parent.....	+0.25*	Towards +0.75	Approach- ing +1.00		+0.60
More unlike parent....	-0.25*	Toward +0.25	0.00		+0.13

TABLE V.
Coefficients of Correlation
(Method 1)

Child with	Simple operations	Copying figures	Average
Midparental standing.....	+0.34	+0.64	+0.49
Like Parent.....	+0.48	+0.72	+0.60
Unlike Parent.....	+0.04	+0.21	+0.13

TABLE VI.
Coefficients of Correlation
(Method 2)

Child with	Simple operations	Copying figures	Average
Midparental standing.....	+0.34	+0.67	+0.51
Like Parent.....	+0.46	+0.73	+0.60
Unlike Parent.....	—0.10	+0.15	+0.02

* These figures have been worked out empirically. (See Table IX.)

(a) Between child and an arbitrary midparental standard half-way between the standings of the two parents, there should be no correlation, that is, the coefficient should be zero.

(b) Between child and more like parent there should in the long run be a positive correlation of about +.25 because the comparison is made each time after choosing the more like of two parents.

(c) Between child and the more unlike parent there should in the long run be a negative correlation of about —.25 because the comparison is made each time after choosing the more unlike of two parents.

A glance at Table IV, which compares the figures actually found with this hypothesis and those that follow, shows that this at least is far from fitting the facts. The figures indicate, on the contrary, a strong resemblance to one parent, and a distinct resemblance to the midparental standing.

(2) If the resemblance is due to heredity alone, there are two extreme cases for which we can foretell the correlations rather exactly. (a) If, on the one hand, the qualities in the child are the result of a perfect blending of those of the parents, the conditions should be these:

i. Between child and midparental standard there should be perfect correlation, diminished only by the tendency to regress towards the mean. The coefficient should be almost +1.00.

ii and iii. Between child and each parent there should be a positive correlation, very much less than one, and very little greater when the like than when the unlike parent is chosen. Again, this does not fit the actual figures (see Table IV).

(b) If, on the other hand, the relations between operations are inherited by each child from one parent only (that is, if there is segregation of these qualities), the following should be the conditions:

i. Between child and midparental standing there should be a positive correlation greater than $+0.50$.

ii. Between child and like parent there should be perfect correlation; that is, the coefficient should be $+1.00$.

iii. Between child and unlike parent there should (unless the parents are correlated) be no correlation; that is, the coefficient should be zero.

Table IV shows that the figures found come closer to this last condition (hereditary with segregation) than might be expected in working on the inheritance of human traits, where heredity correlations are bound to be obscured. So this hypothesis may be at least provisionally retained; and, since the figures fit this and not the previous hypothesis, it must be said that if the resemblance is due to inheritance, there is in the germ cells partial if not complete segregation of the factors involved.

(3) If the resemblance is due to environment alone, we can make no forecast as to the relative values of these three correlations. We must look at the question from the other side; given these resemblances, can we find factors in the environment which may have produced them? Are there relations between the child and his environment which can have acted in such a way as to bring about a strong likeness in these traits to one parent, and practically none to the other? If a child is associated more closely with, or is directly taught by, one parent, will he grow to resemble that one in the relative ease with which he adds and subtracts? If so, children under the same teacher should become alike. They do not, for Mr. Courtis has shown that there is a wide range of variability not only of absolute but of relative facility in the different operations among children who have been under the same teachers and in the same classes,—far wider than the range among averages of children of the same grade, in different schools. That is, their curves vary not only in

position but in form. If the curves of the children owe their shape to association with the teacher, the reverse should be the case. But if the training received from the teacher does not bring this about, it does not seem that association with one parent could effect it, especially when the figures show that the other parent, with whom in many cases he has been almost as closely associated, has had no influence. This is a question on which further tests may throw more light, but if, in view of the approximation of the figures to what we might expect if segregating inheritance were the basis of the likeness, we provisionally accept this explanation, then it must be considered whether training does not introduce a large factor of error in studying the laws of that inheritance.

The coefficients of correlation between child and parent, for the relation of speed in copying figures to speed in the simple processes, are higher than those for the relations between the simple operations themselves. This feature is constant throughout the results. Two possible explanations of this have suggested themselves. The higher correlation may be dependent on the fact that speed in copying figures has a psychological basis somewhat different from the others; it involves fewer factors and requires no "mathematics" whatever. A somewhat more likely hypothesis follows from the fact that in five of the eight families, including seventeen of the twenty children, the scores of the like parents happened to be extremely low in copying figures. Where the parent's variation from the average is so extreme, it may be that the trait is more strongly inherited; and it certainly seems evident that environmental or accidental differences in the curves, which in cases nearer the average might be so proportionally large as to hide the resemblance, would here have to be enormous to do so. Further tests will determine whether this is the correct explanation; if so, it furnishes further evidence that accidental and environmental differences have played a part in lowering the other correlations.

VII. SOURCES OF ERROR

The sources of error, though many, cannot be held to be responsible for the correlations found. It was clear from the curves as they were first plotted that positive correlations such as we have reported must appear. Nevertheless, the sources of error

should be carefully considered; they show that stress must be laid not on the exact figures, but on the general trend of the results. In general, where there is a high correlation, the effect of chance is to lower the coefficient.

The sources of error may be considered in four groups. 1. Errors due to method of gathering data, which have been eliminated as far as possible, and have been discussed under method. 2. Errors due to the variability of the subjects, some of which could not be eliminated. These also have been discussed under method. 3. Mathematical errors. 4. Difficulties in interpretation of the results. These last two sources of error are important enough to deserve special discussion.

The mathematical means which were taken to make the scores comparable, and the method by which a coefficient of correlation was found, are well-established. Coefficients of zero between unrelated individuals, where the expected coefficient is zero, were secured by using the same methods. The data bearing on inheritance are, however, few. When the related pairs (parent and child) are grouped according to the particular trait considered, there are twenty such pairs in each group; as ten traits are considered, the figures for the average of the ten are based on 200 pairs. (Tables IV and VII.) When the related pairs are placed in groups each consisting of ten traits in one child and its parent, there are ten in each group, but twenty groups (Tables V and VIII). The figures for the average of the groups, based on the same 200 pairs, differ from the others by a small per cent. only. Tables VII and VIII give the figures thus obtained. (See also Figures IV and V.)

As to difficulties in interpretation of the results, our fourth source of error, there are many things to consider. In the first place, in comparing each child with his "like parent" a certain amount of correlation is introduced merely by picking out for comparison the parent that is more like the child. If series of groups, each of three persons, were made up at random from an unrelated population, and if then the third member of each group were compared with the more like of the other two in the same group, a certain correlation, due merely to the choice, would show itself. Since this is just the treatment that has been applied to the family groups, it becomes important to know how great is this introduced correlation, and what part of the corre-

TABLE VII.*

*Details of Table V. Correlation Figures**Obtained by First Method*

Relations	Correlation of child with midparental standard	Probable Error	Correlation of child with like parent	Probable Error	Correlation of child with unlike parent	Probable Error
Add.-Sub.	+.52	.17	+.71	.12	-.12	.23
Sub.-Mul.	+.55	.16	+.66	.13	+0.25	.22
Mul.-Div.	+.42	.20	+.52	.17	+0.22	.23
Add.-Mul.	+.57	.16	+.68	.13	+0.32	.21
Add.-Div.	.00	.24	+.09	.23	-.10	.23
Sub.-Div.	-.04	.24	+.21	.23	-.31	.21
Average	+.34	—	+.48	—	+.04	—
Add.-c. f.	+.68	.13	+.75	.09	+.35	.21
Sub.-c. f.	+.72	.10	+.78	.09	+.21	.23
Mul.-c. f.	+.52	.17	+.60	.15	+.06	.23
Div.-c. f.	+.63	.14	+.77	.09	+.20	.23
Average	+.64	—	+.60	—	+.21	—
Combined Average	+.49	—	+.72	—	+.13	—

* The correlations are from twenty parent-child relations, in eight families. These probable error figures are for $n = 8$. If $n = 20$, the probable error is little more than half as great.

lation between child and each parent is to be laid to this treatment. Accordingly, three series of twenty each of just such random groups of three were made up, the third member of each group was treated as "pseudo-child," and correlations both with the more and the less like "pseudo-parents" were obtained. These data are displayed in Table IX. In brief, the correlation introduced by such a choice is +0.25 and -0.25, respectively. It is evident on comparing these figures with the correlations found with the like parent (+0.60) and with the midparental standing (+0.49), that both these figures are enough higher than +0.25 to indicate a distinct resemblance beyond what is due to the choice.

The correlation with the unlike parent is a different matter. If the qualities blend in inheritance, but not perfectly, it is difficult to know what to expect in regard to the less like parent.

TABLE VIII.
Details of Table VI. Correlation Figures
 Obtained by Second Method

Correlation of child with midparental standard in				Correlation of child with like parent in			Correlation of child with unlike parent in		
Case	Relations between simple operations	Relations of simple operations to copying figures	Averages	Relations between simple operations	Relations of simple operations to copying figures	Averages	Relations between simple operations	Relations of simple operations to copying figures	Averages
1	+0.05	+0.95	+0.50	+0.33	+0.96	+0.65	-0.40	+0.91	+0.26
2	-0.99	+0.97	-0.01	-0.80	+0.95	+0.08	-1.00	+0.97	-0.02
3	-0.35	+0.84	+0.25	-0.14	+0.84	+0.35	-0.51	+0.84	+0.17
4	+0.66	+0.99	+0.83	+0.85	+1.00	+0.93	+0.27	+0.97	+0.62
5	+0.26	+0.93	+0.60	+0.54	+0.94	+0.74	-0.18	+0.89	+0.36
6	+0.99	+0.78	+0.89	+0.99	+0.85	+0.92	+0.86	+0.42	+0.64
7	+0.23	+0.85	+0.54	+0.17	+0.94	+0.56	+0.25	-0.08	+0.09
8	+0.32	+0.86	+0.59	+0.33	+0.94	+0.64	+0.29	-0.10	+0.20
9	+0.86	+0.92	+0.89	+0.95	+0.77	+0.86	+0.82	+0.39	+0.61
10	+0.99	+0.87	+0.93	+0.98	+0.70	+0.84	+0.87	+0.59	+0.73
11	+0.29	+0.61	+0.54	-0.06	+0.77	+0.36	+0.24	+0.33	+0.29
12	+0.74	-0.15	+0.30	+0.80	+0.24	+0.52	-0.86	-0.86	-0.86
13	+0.65	+0.85	+0.75	+0.57	+0.68	+0.63	-0.44	+0.63	+0.10
14	+0.31	+0.75	+0.53	+0.91	+0.79	+0.85	-0.32	-0.78	-0.55
15	-0.43	+0.89	+0.23	+0.39	+0.88	+0.25	-0.40	+0.92	+0.26
16	+0.94	-0.32	+0.31	+0.92	-0.19	+0.37	+0.24	-0.41	-0.09
17	+0.78	+0.94	+0.86	+0.75	+0.95	+0.85	-0.55	+0.20	-0.18
18	-0.31	-0.99	-0.65	+0.57	-0.35	+0.11	-0.54	-0.99	-0.77
19	+0.81	+0.98	+0.90	+0.89	+0.97	+0.94	-0.23	-0.97	-0.60
20	+0.09	+0.94	+0.52	+0.11	+0.99	+0.54	-0.37	-0.96	-0.67
	+8.97 -2.08 +20)6.89 +0.34 +0.57 1.017 +0.508	+14.92 -1.46 +20)13.46 +0.67	+10.87 -0.66 20)10.21 +0.51 +0.508	+10.66 -1.39 20)9.27 +0.46 +0.73	+15.16 -0.54 20)14.62 +0.73	20)11.99 +0.599	+3.84 -5.80 20)-1.96 -0.098 +0.145	+8.06 -5.15 20)-2.91 +0.1455 +0.15	+4.33 -3.74 20)0.59 +0.029 +0.02
				1.19 +0.595		+0.595	+0.047 +0.02		

TABLE IX.

Correlation in Pseudo-families. Due to choice of Like and Unlike Pseudo-parents

	Series 3		Series 2		Series 1	
	Like	Unlike	Like	Unlike	Like	Unlike
A.-S.....	+0.07	-0.15	+0.08	+0.03	-0.07	+0.06
A.-M.....	+0.23	-0.01	+0.37	-0.46	+0.58	-0.12
A.-D.....	+0.25	-0.34	+0.38	-0.17	+0.48	+0.08
S.-M.....	+0.07	+0.06	+0.19	-0.17	+0.49	+0.05
S.-D.....	+0.24	-0.38	+0.17	-0.28	+0.15	+0.09
M.-D.....	+0.23	-0.35	+0.28	-0.27	+0.39	-0.05
	+0.18	-0.19	+0.25	-0.22	+0.34	0.00
A.-C.-F....	+0.24	-0.41	+0.06	-0.30	+0.42	-0.25
S.-C.-F....	+0.15	-0.27	+0.19	-0.19	+0.46	-0.38
M.-C.F....	+0.19	-0.28	+0.20	-0.31	-0.31	-0.43
D.-C. F....	+0.14	-0.46	+0.34	-0.19	+0.31	-0.35
	+0.18	-0.36	+0.20	-0.25	+0.29	-0.35

Average of three series for first six combinations (simple operations): Like +0.26; Unlike -0.14.

Average of three series for last four combinations (simple operations with copying figures): Like +0.22; Unlike -0.32.

	Like	Unlike
Combined Average	+0.24	-0.23

If the resemblance found is due to segregating inheritance, so that one parent has nothing to do with these qualities in the child, the expected correlation is 0. The results as shown are as close to 0 as could be expected with so few cases. Indeed, the facts on the whole are very nearly such as would be predicted from segregating inheritance.

But the possible effects of environment in producing this resemblance must also be taken into consideration. The resemblance is undoubted; but we are not safe in ascribing it to heredity at all until we know whether there is any environmental influence which may cause each child to resemble father or mother, but not both. This can probably be tested, but no tests have yet been made. It is nevertheless so difficult to conceive of any factor in the environment which could bring this about, that we may provisionally consider heredity as the most probable cause of the resemblance. Environment and especially the effect of training doubtless modify the original resemblance sufficiently to be considerable sources of error in attempted measurements of heredity.

SUMMARY

1. The resemblance in arithmetical constitution between twenty non-selected children above fourteen years of age and their parents has been measured by the application of the Courtis Tests in Arithmetic, Series A.

2. The scores of these families were compared with norms determined for the purpose by testing two hundred individuals of the same maturity and social and academic status.

3. The resemblance studied was not that between absolute efficiency of parents and their children in addition, subtraction, multiplication, division and copying figures, but that between the relations between these efficiencies obtaining in the child, and the same relations obtaining in his parents. The results show that the relations of a child's skills in the four simple processes to each other and to his speed in copying figures tend to resemble the corresponding relations in one or the other of his parents. His skill in any one process tends to be greater or less than his skill in any other process, according as the parent's skill in that process is greater or less than in that other.

4. A child of either sex may bear this resemblance to either parent, but to one only. The Pearson coefficient of correlation for these twenty children is $+0.60$ when they are compared with the like, and $+0.01$ when they are compared with the unlike parent.

5. A child shows a greater resemblance to the like parent than to the mid-parent: the Pearson coefficients are $+0.60$ and $+0.49$, respectively.

6. It is difficult to avoid the conclusion that this likeness is due to heredity.

APPENDIX I.

Actual Scores (First and Second Trials) of Twenty Children and Parents in Eight Families.

Families 3 and 8 were tested four times, at intervals of four days and nine days respectively

1. Family	Age	Addition	Subtraction	Multipli- cation	Division	Copying Figures
1. Father	52	69 76	60 62	52 60	59 66	108 122
Mother	57	75 77	65 68	51 64	65 74	81 99
Daughter	27	81 85	70 77	52 57	69 69	115 121
Son	26	87 87	64 76	56 67	61 70	112 126
Daughter	22	68 72	60 64	54 59	50 51	110 117
Daughter	20	85 90	72 85	55 70	74 84	106 123
Daughter	19					
2. Father	51	70 75	61 65	48 50	57 59	85 94
Mother	51	66 63	51 49	23 23	39 46	105 108
Son	23	100 97	77 88	51 64	75 81	143 140
Son	21	66 75	55 60	41 54	31 53	93 103
Daughter	19	63 76	56 57	45 54	53 68	113 113
Son	17	62 71	51 54	38 40	48 53	105 112
Son	16	54 68	55 59	31 40	48 59	98 106
3. Father	62	47, 56, 51, 49	49, 48, 49, 52	32, 33, 32, 36	33, 33, 32, 33	93, 100, 105, 110
Mother	55	34, 38, 35, 38	20, 25, 27, 24	24, 30, 29, 24	20, 25, 28, 27	80, 85, 90, 91
Daughter	28	65, 68, 62, 67	54, 62, 57, 53	43, 50, 51, 53	52, 55, 53, 60	112, 120, 128, 125
Daughter	25	77, 73, 70, 78	53, 64, 65, 63	42, 45, 45, 55	40, 50, 54, 57	110, 116, 116, 119
Daughter	22	39, 42, 36, 35	37, 44, 45, 45	27, 28, 42, 44	24, 30, 32, 35	94, 103, 105, 104
4. Father	—	75 80	60 67	49 56	60 62	94 108
Mother	42	65 68	57 62	49 50	52 56	126 140
Daughter	18	76 76	55 61	40 56	58 62	115 121
5. Father	44	61 64	50 44	47 44	35 34	129 138
Mother	—	82 82	69 60	57 68	59 55	150 159
Son	15	56 55	27 32	42 50	49 51	135 143
6. Father	42	84 90	66 67	50 60	60 65	122 130
Mother	—	83 88	57 67	58 67	72 80	119 133
Daughter	15	71 80	50 53	43 58	59 67	119 137
7. Father	61	41 46	35 40	27 29	26 33	55 56
Mother	52	67 66	47 52	47 51	50 57	112 118
Daughter	25	103 113	108 115	60 85	99 115	130 145
Son	18	60 52	39 41	40 43	36 43	125 130
8. Father	44	80, 77, 80, 86	60, 69, 69, 70	53, 56, 60, 58	62, 62, 65, 70	126, 135, 136, 145
Mother	50	57, 47, 50, 52	49, 47, 44, 52	38, 39, 40, 48	38, 44, 46, 49	82, 88, 95, 95
Son	17	45, 50, 41, 48	55, 54, 50, 55	42, 47, 38, 44	51, 50, 52, 53	77, 77, 80, 75
Son	14	63, 63, 64, 62	46, 51, 57, 56	45, 48, 48, 52	37, 44, 46, 50	78, 89, 98, 96

EXPLANATION OF FIGURES IV AND V

The curves in figures IV and V are samples of a large number of curves constructed to express correlations between parent and child. They were constructed by arranging the twenty parents according to rank in the character considered, and placing them at equal intervals along the ordinate or Y-axis (vertical dash line); and arranging the children similarly along the abscissa, or X-axis (horizontal dash line). Then the distance of the parent's rank from the abscissa, and of the child's from the ordinate, determine the position of the point on the curve. It is evident that if the first child were the child of the first parent, the second child, the child of the second parent, and so on, the curve would be a straight line at an angle of 45° to abscissa and ordinate. Departure from this line means departure from complete correspondence between the rank of parent and that of his child. This oblique line, which represents complete correspondence in rank, has been drawn in over the curves. But it has been run not from corner to corner of the figure but through the zero point, where X-axis and Y-axis cross. It should be understood that the position of the X-axis and of the Y-axis represents the average position obtained from the scores of 200 unrelated individuals already mentioned. The fact that the intersection of these axes does not lie in the center of the squares is due to the fact that the parents and children in the twenty families here charted are not equally distributed above and below this average. This combination of rank and absolute standing is perhaps unjustifiable, for it is the line from corner to corner which represents perfect correlation as far as rank is concerned. But if this is kept in mind, the method is not misleading; and though it is of course a rough and ready method, it has seemed to be clear and convenient.

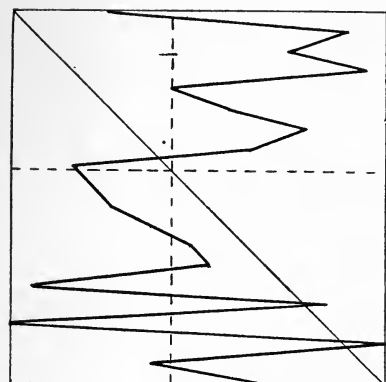


FIG. IV (A)

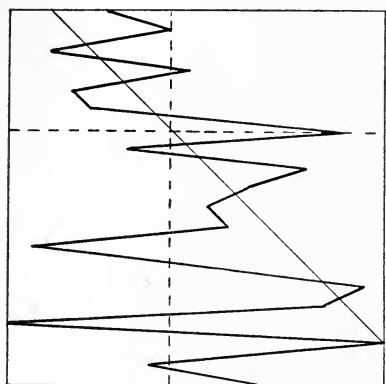


FIG. IV (B)

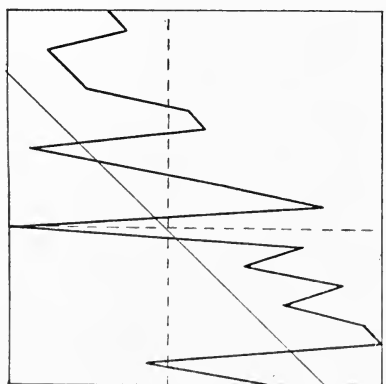


FIG. IV (C)

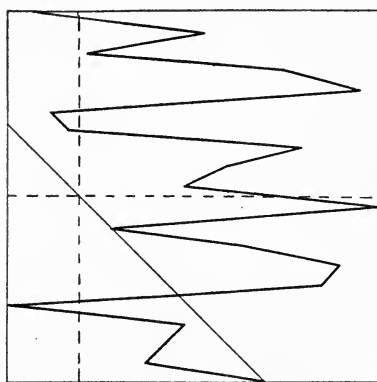


FIG. V (A)

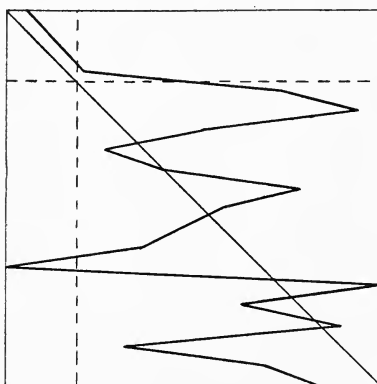


FIG. V (B)

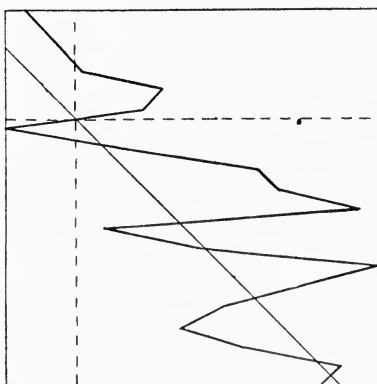


FIG. V (C)

Fig. IV. Curves representing correlation in rank among twenty parent-child pairs, in addition.
 A—like parent. B—midparental standing. C—unlike parent.
 Fig. V. Curves representing correlation in rank among twenty parent-child pairs, in the division—copying figures relation.
 A—like parent. B—Mid-parental standing. C—unlike parent.

APPENDIX II.

Deviations from the Mean Expressed as Multiples of the Standard Deviation, for Sixteen Parents and Twenty Children (Eight Families)

Used in Calculating Coefficients of Correlation

1. Family	Addition	Subtraction	Multiplication	Division	Copying figures
1. Father	-0.03	+0.07	+0.27	+0.32	-0.53
Mother	+0.20	+0.54	+0.41	+0.82	-2.00
Daughter	+0.67	+0.96	+0.14	+0.79	-0.35
Son	+0.93	+0.71	+0.77	+0.54	-0.29
Daughter	-0.20	+0.14	+0.32	-0.54	-0.62
Daughter	+0.97	+1.32	+0.86	+1.50	-0.56
Daughter	0.00	+0.18	-0.32	+0.21	-0.56
2. Father	-0.03	+0.21	-0.36	0.00	-2.03
Mother	-0.47	-0.64	-2.73	-1.11	-1.03
Son	+1.80	+1.61	+0.41	+1.43	+1.12
Son	-0.17	-0.18	-0.50	-1.14	-1.53
Daughter	-0.23	-0.25	-0.32	+0.18	-0.65
Son	-0.43	-0.54	-1.27	-0.54	-0.91
Son	-0.80	-0.21	-1.59	-0.32	-1.30
3. Father	-1.47	-0.75	-1.82	-1.79	-1.30
Mother	-2.47	-2.57	-2.36	-2.36	-2.21
Daughter	-0.50	-0.25	-0.36	-0.21	-0.18
Daughter	+0.10	+0.07	-0.55	-0.57	-0.53
Daughter	-2.33	-1.21	-1.64	-2.00	-1.32
4. Father	+0.30	+0.25	-0.05	+0.21	-1.35
Mother	-0.43	-0.04	-0.32	-0.29	-0.53
Daughter	+0.20	-0.14	-0.45	+0.14	-0.35
5. Father	-0.70	-0.71	-0.55	-1.64	+0.56
Mother	+0.60	+0.64	+0.77	+0.07	+1.79
Son	-1.13	-2.18	-0.64	-0.57	+0.88
6. Father	+0.93	+0.46	+0.18	+0.32	+0.12
Mother	+0.83	+0.14	+0.86	+1.29	+0.12
Daughter	+0.17	-0.61	-0.23	+0.36	+0.24
7. Father	-1.97	-1.61	-2.27	-2.04	-4.03
Mother	-0.40	-0.75	-0.36	-0.32	-0.53
Daughter	+2.33	+3.68	+1.77	+3.50	+0.79
Son	-0.87	-1.43	-1.05	-1.32	+0.21
8. Father	+0.53	+0.50	+0.36	+0.50	+0.68
Mother	-1.43	-0.68	-1.09	-1.00	-2.00
Son	-1.80	-0.46	-0.91	-0.46	-2.76
Son	-0.67	-0.54	-0.55	-1.00	-2.00

THE AUDITORY MEMORY AND TACTUAL SENSIBILITY OF THE BLIND

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Certain differences between the blind and seeing persons—notably in the excellence of memory for things heard and in tactual sensibility—have been long recognized, but the extent of these differences has not been accurately determined. This paper presents some quantitative data bearing on the question of how much superior the blind are to normal persons in mental accomplishments which are naturally relied upon because of the loss of sight. It answers the question, however, only for one group of blind boys in school, and the conclusions reached may not be altogether true of the blind as a class.

The study was made in 1914 in the Houghton Grammar School, the Rindge Technical High School, Radcliffe and Harvard College classes (all in Cambridge, Massachusetts); and the Perkins Institution for the Blind, Watertown, Massachusetts.

I. OBJECTS OF THE INVESTIGATION

The report makes

1. A comparison of the abilities of the Perkins Institution boys with students of normal elementary, high school, and college groups in reproducing in writing the elements of a simple story after hearing it read once. This is known as the "Reproduction Test."

2. A comparison of the abilities of the same groups (with the exception of the elementary grades) in regard to the retention of the elements of the story after an interval of five days. This is known as the "Retention Test."

3. A comparison of the immediate memory of the Perkins Institution boys with normal boys of about the same age in the Rindge Technical High School for lists of letters and figures. This is known as the "Immediate Memory Test."

4. A comparison of the abilities of these two groups of boys in regard to solving a complicated form board puzzle. This is known as the "Form Board Test."

II. METHODS OF CONDUCTING THE TESTS

The Reproduction Test

For testing logical memory, the story entitled "The Golden Goose," in Pyle's "The Examination of School Children" was used. The groups examined were the following:

(a) Grades II to VIII, inclusive, in the Houghton Grammar School. Number of pupils examined, 254, there being on the average 36 pupils to a class.

(b) A class in the Rindge Technical High School. There were 20 pupils in the class.

(c) A class in educational psychology in Harvard University. 14 students were tested.

(d) A class in educational psychology in Radcliffe College. 18 students were tested.

(e) A class in the Perkins Institution. There were 19 pupils in the class.

The story was carefully read once to each of the above groups, at different times. After the reading each person wrote on paper all the elements of the story he could reproduce. The Perkins Institution boys wrote with Braille-writers or typewriters. There was no time limit. The tests were uniformly conducted. In all, 323 individuals were examined.

When all the papers were collected, they were examined for the purpose of deciding what should constitute the various elements of the story. There were found to be fifty elements in the complete story. Using that number as a basis, each paper was given a percentage. The charts on opposite page show the results obtained.

In chart I, the percentages of pupils in the various classes capable of reproducing from 67% to 100% of the elements of the story are represented; *e. g.*, all, that is 100% of the blind boys reproduced between 67% and 100% of the story. Whereas, but 60% of the Rindge boys, with whom, in age, training, etc., they are most nearly comparable, could reproduce this much of the story.

In chart II, the average abilities of the several groups are compared. The tops of the columns indicate the average percentage reproduced. The blind boys lead with an average percent. of reproduction of 87.7%, the Rindge boys having an average percent. of reproduction of 69.9%. The Radcliffe and Harvard students have somewhat higher percentages than the Rindge but considerably less than those of the blind.

LOGICAL MEMORY

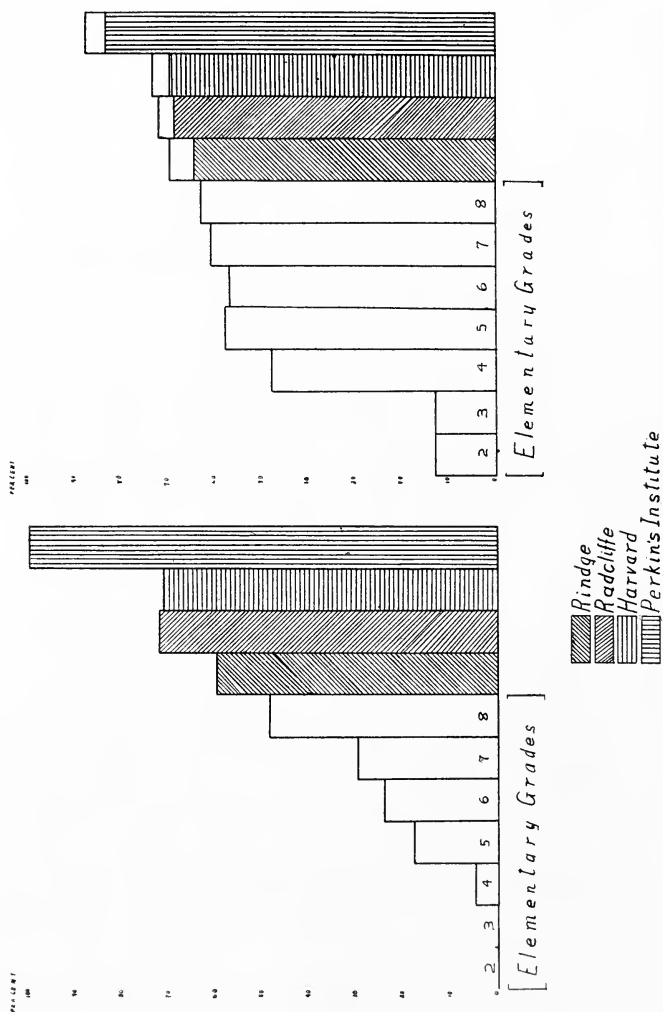


Chart I. Percentage by classes of those reproducing between 67% and 100% of the elements of the story.

Chart II. Average percentages of reproduction and retention. The tops of the columns represent the average per cent. reproduced; the shades parts of columns indicate the proportion retained after 5 days.

The Retention Test

The groups examined for the retention of the elements of the "Golden Goose" were the same as for the test just described except that the elementary grades were not included.

After an interval of five days from the reading of the first test, the persons examined were asked to reproduce again as many of the elements of the story as possible. They had not been told that the test would be repeated. Those who had considered the story since the first writing were asked to indicate that fact on their papers. Their papers were not included in the results of this test. There was no time limit.

These papers were carefully examined, and given percentages as in the first case.

The shaded parts of the columns in chart II indicate that proportion of the reproduced matter which was retained after five days. The actual percentages are as follows: Perkins Institute, 95.9%; Radcliffe, 95.2%; Harvard, 95.1%; Rindge, 92.4%.

The Immediate Memory Test

The groups examined for immediate memory of lists of letters and numbers were a class of boys in the Perkins Institution (not in all cases the same pupils as considered above) and a group of boys in the Rindge Technical School of about the same ages.

There were seven lists in all, four of letters chosen at random and three of numbers chosen in like manner. These lists varied from twelve to fifteen letters or numbers respectively. Each list was read once, then the students reproduced as many of the units of it as possible. The tests were marked I to VII inclusive, the first four being of letters. The Perkins Institution boys used Braille-writers and typewriters for their lists. There was a time limit of thirty seconds. The tests were uniformly conducted.

Incorrect letters or numbers omitted and additional ones were counted as errors in assigning percentages to the papers. Nineteen blind boys and twenty Rindge boys competed in this test. The results obtained are tabulated below. (The numbers are the percentages correctly reproduced.)

Test.....	I	II	III	IV	V	VI	VII
Rindge.....	46.9	46.2	46.5	48.6	49.4	65.7	67.2
Perkins.....	55.2	49.9	46.0	44.1	51.4	44.9	54.4

For example, the Rindge students were able to produce 46.9% of the letters correctly in Test I, while the percent. for the Perkins Institution boys is 55.2. It will be noted, however, that the percents. do not indicate a dominant superiority in the favor of either group, the Perkins boys being as often below as above their competitors in average abilities. There is some evidence of the effect of practice in the course of the seven tests in the case of the Rindge pupils, which does not appear in the results of the blind boys.

The Complicated Form Board Test

The groups were the same as for immediate memory. They were not, however, in all cases the identical pupils. For a test of tactual and kinaesthetic sensibility, a form board puzzle was used into which blocks of various forms exactly fitted into correspondingly shaped depressions. In some cases two or more blocks were required to fill the depression. The Rindge students were blind-folded. The test was given individually in succession.

A preliminary period of thirty seconds was allowed each pupil for the purpose of learning the locations of the depressions and the shapes of the blocks. Except for this, there was no time limit, but the time required in each case to place each block correctly into its proper depression was carefully noted. Each boy's age was noted also. Every attempt or accomplishment of placing the wrong blocks in a depression was counted as an error. The results of this test are shown below by averages.

	Age	Errors	Time
Perkins.....	16 yrs. 8 mo.	3.8	4.2 min.
Rindge.....	17 yrs. 5 mo.	12.6	5.9 min.
Difference.....	+9 mos.	+ 8.8	+1.7

That is, the Rindge boys are nine months older, take one and seven-tenths minutes longer, and make eight and eight-tenths more mistakes than the Perkins Institution boys.

III. SUMMARY

The conclusions which may be drawn from this particular investigation are as follows:

I. The blind boys of the Perkins Institution as a group are superior in the memory for a passage of prose read to them to a normal group of boys of approximately their own age, and to classes of adult college men and women. The extent of this

superiority is shown by a comparison of the averages of the groups in chart II, and still more strikingly by chart I, where the Perkins Institution boys are found entirely in the highest division.

II. The blind as a class retain a somewhat higher percentage of the elements in logical memory than do any other group. This is shown by shaded portions of chart I, which represents the Perkins boys leading with an average of 95.9% of their original ability.

III. The superiority shown in the logical memory of the blind does not manifest itself in immediate memory for numbers and letters. The reason for this difference appears to the writers to be that the immediate memory for numbers and letters is in comparison with the logical memory a relatively unpractised ability in the case of all subjects.

IV. The higher degree of sensibility to touch and to the feelings of movement and position in the blind is demonstrated. Normal boys about nine months older than the blind boys require nearly half again as much time, and make about three times as many mistakes, in solving a complicated form board puzzle.

The study, as a whole, gives some definite notion of the extent to which prolonged special training may develop special abilities.

The blind as a class are trained to listen attentively and their educational system depends on the high development of the sense of touch. They have exceptional need for the development of these senses; for they must remember what is told them or be subjected to numerous inconveniences and difficulties, and they cannot read their Braille books unless their finger-tips are highly trained. For these reasons they devote years to the special training of these senses.

The effect of this training appears in the excellence of memory for the passage of prose read to them. In the case of the immediate memory for isolated numbers and letters, they are likely, however, to receive no more training than ordinary individuals, and they show no superiority. This indicates that their special abilities are limited to the things in which they are especially trained, and supports the results of other experiments in showing how narrow may be the influence of special training. It should be added, however, that the significance of this last conclusion is lessened by the fact that even direct practice in the case of the auditory memory span for numbers, letters, etc., is relatively limited in its effect.

THE WOOLLEY-TEST SERIES APPLIED TO THE DETECTION OF ABILITY IN TELEGRAPHY

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An extensive series of tests is being standardized by Mrs. Woolley in Cincinnati for different "age" and "social" groups. Their norms are being more and more carefully fixed. But no direct comparison has as yet been made of the records of ability in these tests with specific abilities of a practical kind. The present investigation carried on at the Vocation Bureau of Cincinnati, is a meager attempt to judge the value of the Woolley tests as indices of future capacity in telegraphy.

A group of boys, in two divisions, employees of the Western Union Telegraph Company were used as subjects. These boys (15 years old) were employed by the company every other week as messengers, and, during the alternate weeks, received instruction in telegraphy in the "Telegraph Boys Continuation School," of Cincinnati, a part of the public school system. The instruction was partly in the hands of Miss L., a continuation school teacher who was adept in telegraph-operating, and partly under the control of Mr. P., an expert main-line operator sent by the W. U. Tel. Co. Both teachers were in constant contact with each boy, and were remarkably successful in stimulating the boys to interested activity.

This school began in March, 1915, and all of the boys included in this study entered the school at that time or very soon afterwards. During the month of August, 41 boys who had been in regular attendance in the school were given the series of tests used by Mrs. Woolley in making up her 15-year-old norms for "working boys." There were 22 of this original number who remained into the month of December, that is, who had had practice in telegraphy for approximately 8 months. The progress of the boys in their work was considered by Mr. P. to be very encouraging, and the degree of skill acquired can be indicated by the fact that the boy judged by him to be the best (although not markedly superior to others) was then capable of taking a regular operating position, and was waiting for the first opening the company had.

In evaluating the telegraphic skill of the different boys, only one type of measurement was used,—the judgments by the teachers of the rank of each individual in the group. Both of the teachers who were with the boys constantly, ranked them in order of merit from best to worst, at two specific times.

(1) A preliminary judgment was made of the original 41 boys, at the time of giving the tests, in August.

(2) A final judgment of rank was made of the 22 boys who remained in the school for the 8 months, up to December. Only these 22 individuals are considered in this study.

This final judgment of ability of the boys is assumed to be a fair measure of the relative ability of the individuals in telegraphy, or better perhaps, their ability to "make good" in this field. In the first place, the teachers were in constant touch with each boy, and had been more or less consciously considering the relative ability of the individual boys for 4 months. Secondly, they were asked to make their final judgments largely on the basis of their opinion of the "final" operating capacity of the individual boys. They consequently gave due consideration to the interest and effort aspect of the work.

Since all of these 22 boys had worked during the same period of time as messengers in the W. U. Tel. Co., it was thought of interest to go to the men who had them in charge and get a judgment from them as to the relative efficiency of each boy as a messenger. Two men who had supervised this messenger-service ranked them accordingly. There were then, in all, five sets of judgments of rank of the 22 individuals who had practiced telegraphy for 8 months,—a preliminary and a final judgment by both Miss L. and Mr. P. and a messenger service judgment. Neither of the ranking individuals was in any wise aware of the grading of the others.

The educational background of the individual boys is significant. Only 2 of the 22 boys had completed the 8th grade of school work, while the rest were retarded in school work in varying degrees. Two, for instance, were attending special 4th grade classes. The "grade-completed," then, will be considered as an index of the educational status of the individuals.

The judgment of the value of the Woolley tests in indicating telegraphic ability is made in two ways. (1) A series of correlations was found between the various tests and the judgments of the teachers, by means of the Pearson "rank" method of

determining the correlation index ($\rho = 1 - \frac{6d^2}{n(n^2-1)}$), reduced

to the r-equivalent by the formula $r = 2 \sin(\frac{\pi}{6} \rho)$. (2) For the purpose of a more accurate analysis of the individuals a table was made up showing the relative standing of the individuals in estimated operating-ability together with their rating in the tests on the basis of the Woolley scales (published in the JOURNAL OF EDUCATIONAL PSYCHOLOGY, November, 1915). Seven boys out of the 22, who had worked for 8 months, were considered by Mr. P. to be failures, absolutely incapable of ever making desirable telegraph operators. The question presents itself; have we, on the basis of the standings of the boys in terms of the Woolley norms, a means of sorting out the desirable from the undesirable candidates in such an ability?

(1) There was close agreement between the judgments of the two teachers, especially in the final rankings made ("r" = .81 in the case of the preliminary judgments, and .91 for the final judgments, with probable errors of .052 and .025 respectively). Between the first and final judgments of L. the correlation index, "r," was .68, while that of P. was .70 (.88 when the judgments were combined into one).

The correlation index was found between each teacher's ranking (and the combined ranking) and all of the measurements used in the case of 15-year-old boys by Mrs. Woolley. Many of the indices are so small they are not worth tabulation, and only the correlation indices of the final combined ranking of the two teachers will be mentioned with these cases. In cancelling the "m"s on the Whipple small-letter cancellation blanks, for example, both the accuracy and the time-index showed a slight negative correlation with telegraphic ability ("r" = —.13, and —.16 respectively). In the substitution test measurements, the indices were all negligible in amount with one possible exception. When the total time taken on the three learning pages was considered correlation index with telegraph ability was "r" = .39. This test has been considered a typical learning test, the object being to learn a set of symbolic connections during three pages of writing and on a fourth page make appropriate substitutions from memory. Curiously the "r" between the accuracy of the final memory page and the teachers' final ranking was —.08.

The immediate memory tests,—reproducing immediately 2 sets of 7, 8, and 9 place number series which are exposed to the subject,—showed low correlation indices with estimated operating ability when the different length sets were considered alone, but a fairly high index when all were combined. The “Opposites” test gave substantial indices of correlation, the “accuracy” standing especially high with Mr. P.’s ranking. The various measurements of the “sentence-completion” test were all well correlated with the teachers’ rankings with the exception of the “number of ideas” written, whose correlation index was .39. This test, designed to measure a subject’s ability to “complete sentences quickly” (whose beginnings are exposed), to write these sentences correctly, and to use a large variety of ideas in the time taken, seems to be widely applicable as a general intelligence test.

Three additional tests were tried without positive advantage. The times taken for the Healy and Fernald puzzle box and for the Healy small “A”-formboard gave correlation indices with the teachers’ rankings of $-.01$ and $.05$ respectively; and a recognition test,—in which previously exposed geometrical forms were to be identified after their mixture with other similar forms,—gave an index of $-.08$. It was thought previously that this last test might relate closely to the capacity needed in telegraph operating.

The six test measurements most highly correlated with telegraph ability, as estimated by the teachers, are tabulated below in connection with their correlation indices with the preliminary and final judgments of the teachers’ estimates (when these are combined), also with the final judgment of each individual teacher, and with the grading as given by the messenger-service supervisors. Finally the six highly correlated tests have been pooled together,—their average standings taken for each individual on the basis of their values in the Woolley norms,—and this result correlated with each of the rankings. Here a high index of correlation is shown, especially in the case of P’s final judgments, although this is not very superior to the relationship between telegraphic ability and the “school grade-completed” (also included below).

TABLE I.

Correlations

	Combined estimate of teacher		Final ranking of		Efficiency as messenger
	Preliminary	Final	P.	L.	
All Woolley-tests,					
combined percentiles...	.54	.52	.54	.51	.26
Immediate memory, ave...	.55	.52	.43	.55	.24
Opposites test, Acc.....	.58	.59	.66	.41	.37
Opposites test, Index.....	.36	.51	.55	.51	.21
Sentence completion test,					
No. correct sentences...	.36	.52	.53	.55	.19
Association speed.....	.37	.52	.56	.56	.39
Index, Ideas time.....	.51	.48	.53	.39	.54
Ave. of 6 selected					
tests (from norms).....	.61	.79	.81	.76	.44
School grade completed...	.67	.77	.79	.72	.30

In general, it should be said that the "probable error" values vary from .151 for a zero value of "r" to .126 where "r" equals .40 (the lowest value of "r" for a reliable indication of relationship), to .113, .094, .077 and .054 for values of P.E. when "r" equals .5, .6, .7, and .8 respectively. Finally, it is interesting to note that the correlation between the final combined ranking for telegraphic ability and the ratings given by the messenger service supervisors was negligible, ("r" = .11). This shows that a general industrial efficiency factor was not conspicuous, and that the telegraphic ability as measured is a fairly specific function.

(2) For the purpose of showing more definitely the diagnostic value of the six most highly correlated measurements the following table (II) has been devised. As stated above the main line expert, P. insisted that 7 of the boys were incapable of ever attaining sufficient ability to hold operating jobs. Miss L. was not so dogmatic but agrees very closely with P. in her judgment of the inefficient. The standings of the "successful" individuals, the 15 ranked the highest, are contrasted with the standings of the "failures," the 7 lowest of the group. The numbers included below in parenthesis indicate the "decile" groups into which the individuals fall in the different tests, on the basis of the 15-year-old "working-boy" norms established by Mrs. Woolley. That is, (2) indicates that the subject stood between the poorest 10% and 20% points in the records of the working-boy group tested at Cincinnati. The other numbers refer to the rank of the individuals in the group of 22 boys, *e. g.*, "2" indicates that the individual was the next to the best.

TABLE II.
Ranking of Individuals
 Tested Boys Who had Remained in School for 8 Months

Ranking of	Successes												Failures									
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.	U.	V.
Mr. P.....	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Miss L.....	1	2	3	7	5	10	11	12	8	4	9	6	14	13	16	15	21	19	17	18	22	20
School-grade completed.....	6	6	7	8	7	8	7	6	6	7	7	5	5	6	3	5	5	3	5	5	5	4
Decile value																						
All tests.....	(8)	(1)	(10)	(8)	(4)	(5)	(8)	(9)	(1)	(10)	(6)	(6)	(7)	(5)	(1)	(5)	(3)	(1)	(5)	(3)	(3)	(1)
Imm. memory.....	(4)	(4)	(8)	(4)	(6)	(3)	(2)	(7)	(1)	(10)	(2)	(5)	(3)	(6)	(2)	(5)	(1)	(3)	(3)	(3)	(3)	(1)
Opposites, acc.....	(3)	(6)	(9)	(8)	(6)	(9)	(8)	(6)	(2)	(9)	(10)	(1)	(3)	(3)	(4)	(2)	(2)	(1)	(1)	(3)	(3)	(1)
Opposites, Index.....	(8)	(1)	(8)	(3)	(3)	(2)	(8)	(2)	(4)	(8)	(2)	(4)	(6)	(3)	(5)	(1)	(3)	(1)	(1)	(1)	(1)	(1)
Sentences																						
No. correct.....	(2)	(8)	(8)	(8)	(8)	(4)	(8)	(4)	(2)	(8)	(8)	(1)	(8)	(2)	(2)	(2)	(4)	(1)	(4)	(8)	(1)	(2)
Ass'n speed.....	(10)	(2)	(3)	(10)	(8)	(2)	(10)	(8)	(7)	(4)	(8)	(4)	(6)	(1)	(4)	(5)	(5)	(1)	(2)	(1)	(2)	(1)
Time-index.....	(9)	(3)	(4)	(7)	(8)	(2)	(10)	(9)	(2)	(8)	(3)	(7)	(6)	(4)	(5)	(2)	(4)	(1)	(1)	(1)	(6)	(1)
Rank acc. to six tests.....	6½	10	3½	3½	5	12	2	6½	16	1	8	12	9	14½	12	17½	14½	22	20	17½	19	21

It is plain that no one of the test measurements is infallible in its ability to eliminate the misfits. The opposites test and the combination of the six selected tests come closest to this. One exception to this finding, individual "I" might be considered in passing. This boy was large for his age, very serious and interested in the work. His natural slowness was compensated for by an especially pronounced effort. Other similar though lesser discrepancies can be accounted for by language and educational differences.

DISCUSSION AND CONCLUSIONS

(1) There seems to be no clear indication of relationship between efficient messengers, as rated by the company officials, and ability as measured by the mental tests. The measurement of the "time-index" in the sentence test is a possible exception to this.

(2) The type of ability evidently demanded in telegraphy seems to be fairly highly correlated with ability as measured by certain of the psychological tests. When six of these records are pooled together the correlation of the result with the ability to telegraph (as judged by the main-line expert) is significantly high (" r " = .81). In spite of the comparatively small number of individuals tested, it seems reasonable to conclude that the use of the tests for predicting probable success in this field is warranted. This is especially true in view of the fact that the correlations between the first and final rankings of the individual teachers was less than the above amount, (r = .68 and .70 for L. and P. respectively). In other words, by immediate testing of a group of boys with certain selected tests, (only 3 in this case) it seems probable that more can be told regarding their future telegraphic ability than by judgments of individual teachers of telegraphy 4 months after they have had the boys under their direction.

(3) It is impossible to predict in advance what tests will correlate highly with special kinds of abilities. The substitution test measurements and the recognition test are striking evidences of this, in that they seem to indicate no close relationship with the ability in question; while the opposites test, and sentence test measurements give high correlation indices with estimated telegraphic ability.

(4) It is very significant that "school-grade-completed" corresponds so highly with ability in telegraph operating. This is true in spite of the fact that the boys were recruited from all parts of the city, from public and parochial schools, and that in the case of Mr. P., at least, there was no knowledge of the exact grades which these boys had completed. It seems probable that boys who have not passed the 6th grade at the age of 15 will rarely make good in telegraphy.

(5) Finally, it can be seen from the second table that users of psychological tests can never afford to be mechanical. Language difficulties and striking discrepancies in applied effort and interest will always make differences. The remarkable thing is that without eliminating these various factors in the least we have such high correlations between the final judgments of telegraphic ability and the selected test results. By taking account of school standing, and records from selected tests, it ought to be possible to eliminate many individuals from special courses of this type to the benefit of the school and the individual.

PUPILS' ESTIMATES OF TEACHERS

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Is the pupil's opinion or the estimate of the superintendent the more accurate gauge of the teacher's efficiency? The superintendent is, of course, capable of more mature judgment, but the pupil through intimate daily acquaintance with his instructor, possesses more data and evidence upon which to base a decision. No doubt the ideal teacher of whom so much has been said and written fulfils the requirements of both.

The results of investigation by Boyce, Ruediger and Strayer¹ indicate that from the point of view of the supervisor the most important qualifications of a teacher are instructional skill, discipline, initiative and experience. According to Sherman Littler,² the usual reasons for the failure of teachers are poor discipline, weak personality, lack of teaching skill, lack of interest, laziness, failure to coöperate or poor health. It was found by Miss Moses³ that among twenty-six school systems the ten most frequent causes of failure were poor instruction, weakness of personality, lack of interest, weakness in discipline, lack of sympathy, inability to coöperate, unprofessional attitude, weakness in knowledge of subject matter, disloyalty, immorality, and poor health. Buellesfield⁴ concludes that weakness of discipline, lack of judgment, deficient scholarship and poor methods of instruction are the chief reasons for lack of success. From these causes of failure it is evident what qualifications those unsuccessful teachers should have possessed.

W. F. Book⁵ investigated the subject from the point of view of 1067 senior high school students from eight different states, who were asked to write a composition on High School Education, including a discussion of their teachers. The traits of character most appreciated are included in the terms sympathy and kindness, good humor, patience, sociability, firmness and courtesy—in short, the most fundamental social virtues.

¹ *Methods for Measuring Teachers' Efficiency*—(Pub. U. of Chicago Press) 1915.

² *Causes of Failure Among Elementary School Teachers*—School and Home Education, March, 1914.

³ *School and Home Education*—January, 1914.

⁴ *Causes of Failure Among Teachers*—Educational Administration and Supervision, September, 1915.

⁵ *The High School Teacher from the Pupil's Point of View*—Pedagogical Seminary, September, 1905.

Another early investigation of the subject from the pupil's standpoint was made by Kratz,⁶ who collected from 2411 girls and boys in grades one to eight inclusive, descriptions of the best teacher they had ever had, without naming her. The qualities mentioned in order of preference are kindness, patience, politeness, neatness and discipline.

The usual standard efficiency records and the expected requirements of employers place personal appearance, health and voice first. If by appearance and voice are meant the visible and audible signs of true character, and not mere superficial externals, no doubt these requirements are very closely related to the requirements of pupils. Very few of the boys and girls who were questioned, however, demanded any one of those qualities in the form designated. Reasonable health is without doubt desirable and necessary in any kind of work. A conspicuous omission in all the efficiency records obtainable is a sense of humor, which in the school room is often all that resolves a difficult complication in discipline. Fortunately the value of this mental tonic is more highly appreciated among pupils.

To test the conclusions already published and to carry the investigation a step further, data were collected by the writer from one hundred thirty-nine high school girls, two hundred fifty-three high school boys, and one hundred fifty normal school students, who were asked, without previous warning, the question, "What are the five or six best qualities of the best teachers you have ever had?" The answers were written without discussion, during a class period, and were passed in unsigned, in order that every statement might be thoroughly candid. The ten qualities receiving the largest average percentage of votes were considered sufficient for a working basis. In order that one convenient term might be used to designate each quality, wordy expressions were condensed or synonyms construed, but no meanings were changed or interpreted too broadly. In many instances qualities were repeated by the same student, or less than the number of characteristics requested were given. "Humor," for example, was expressed as "Loved fun," "Jolly," "Told funny stories," or "Appreciated a joke." Pupils in the elementary school were not interrogated. Inexperience, lack of judgment, errors of imagination, and vagueness of expression

⁶ *Observations in the School Room*—Chap. 5 (Ed. Pub. Co.)

make it difficult to obtain reliable data from most pupils below the high school.

The percentages of frequency and their distribution show agreement that the ten most important qualities are fairness, kindness, sociability, sense of humor, good temper, ability to discipline, neatness, patience, adequate preparation, and ability to impart information. With girls, kindness ranks first. Among boys fairness is the most appreciated. This sex difference is probably due to training and experience rather than original nature. Sociability is more appreciated by normal school students than by either high school girls or boys. Discipline is held in much esteem by high school girls, less by boys, and still less by normal school students, whose deportment and business attitude toward study do not usually demand it. Owing to established precedent neatness receives more emphasis from girls than from boys. Patience, which is appreciated by all, ranks highest with high school girls. Clearness of explanation is demanded by high school pupils, especially by girls, no doubt because of the difficulty of new subjects studied in high school for the first time. A strong desire for direction and encouragement is evidenced by all.

Some of the qualities which received an average of one vote or less in each of the three groups were health (offset by one boy who stated that the best teacher he ever had was ill half the time), being up-to-date, well-dressed, refined, practical, definite, natural, self-confident, broad-minded, systematic, experienced, faithful, and showing "A sportsman-like attitude toward life." A small percentage mentioned interest in work, strong personality, alertness, resourcefulness, interest in outdoor sports, a business-like manner, confidence in pupils, an entertaining way of teaching, punctuality, politeness and good judgment.

A few expressed themselves at some length and with considerable show of feeling. "Did not make us stay after school," said one. "Treated me well and told me how to do the examples. Gave me a chance to make my lessons up," remarked another. "Showed that they liked their job," ventured a third. Others added, "Because she was always square and did not have any pets"; "Never gave too much home work"; "He treated me with respect and was polite and courteous"; "Because she smiled once in a while"; "Lent me his knife"; "Didn't get mad the first time but gave a fellow a chance"; "Acted as one of the class,

not as a more learned being"; "Never made a promise but she fulfilled it." Faults strongly condemned are favoritism, hypocrisy, sarcasm, lack of sympathy, lax easy methods, and lack of confidence in pupils. "Let a pupil see that you believe in him and he will seldom disappoint you," said one boy. "What we get in high school," wrote one of the girls, "depends on the teacher we have," which is an echo of Emerson's dictum, "It makes little difference what you study in school, but it is in the highest degree important who your teacher is."

More evident agreement is noticeable among the girls than among the boys. Most of the statements volunteered by only one individual were contributed by boys, girls expressing less individual opinion. This accounts for the fact that the comparison-distribution chart is more depressed for the boys, in spite of the fact that their group contained a larger number of individuals than occur in either of the other two accompanying groups. This general agreement among girls may be the result of their usual habit of discussing people at greater length and in more detail with one another than is customary with boys. An added factor might be the strong imitative tendencies of girls, who often acquiesce with popular opinion.

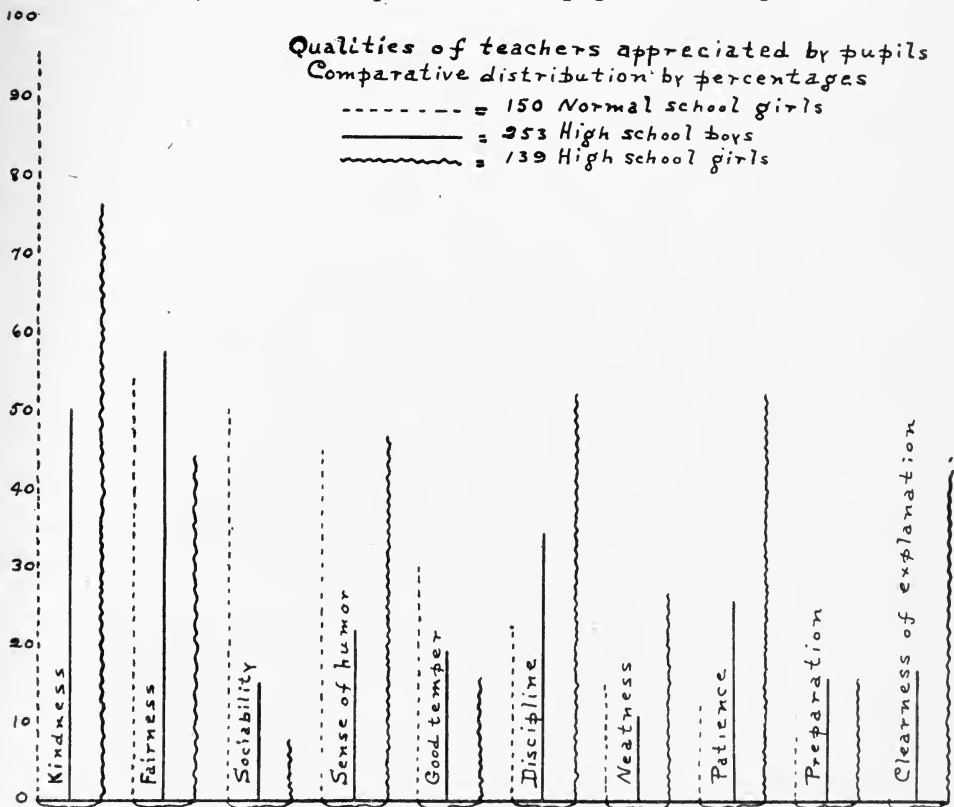
On the whole, no sex preference is emphasized. The feminine personal pronoun is used oftener than the masculine in describing favorite teachers; probably because most of the teachers in the schools are women. Also, there appears to be no appearance qualification. Some appreciation was expressed for the young teacher, for the reason that she is "Full of life," "Up-to-date," and "In sympathy with boys and girls."

In general, the results of this study agree closely with investigations already made. In fact, many of the descriptive expressions characterizing favorite teachers were found to be identical with those appearing in former experiments. A few recurring frequently in all the investigations are, "Is one of us," "Jolly and pleasant out of school," "Not afraid to laugh," "Trusted us and put us on our honor," "Did not spy on us," "Took an interest in us out of school," "Made recitations interesting," "Encouraging and cheerful," "Always had something pleasant to say," "We always studied our lessons for her," "We always did our best for her."

Very close correlation exists between the opinions of boys and of girls, of high school and of normal school students. Because

the number of pupils in the different groups is unlike, percentages of frequency are used, for the sake of uniformity, to indicate the popularity of each quality. By the Pearson product-moments formula, the correlation between the opinions of high school girls and high school boys is .80. Between high school girls and normal school girls is .88. The probable error for the first correlation is about .05, and for the second .07. Similar closeness of comparison has been indicated by casual conversation with over twenty teachers of experience, who, after the lapse of many years, recall as the qualities of their former best instructors, the same characteristics appreciated by the pupils whose reports have served as the foundation of the foregoing experiments. It seems convincing that these requirements are essential.

If the lists of qualifications demanded by employers, the causes of failures, and the requirements of pupils are compared, the



parallelism of desirable characteristics is no doubt closer than it seems, because of the similarity of idea behind loose, general terms, which at first glance may be interpreted as indicating different qualities. One requirement which appears in every such list of requisite qualifications is discipline. This in its best and broadest sense, perhaps, includes all the others. Without juggling with terms, however, the fact remains that pupils appreciate most the ordinary virtues fundamental to character. Employers, because they are often obliged to select teachers on chance impression, and are unable to observe instructors' work oftener than semi-occasionally, are forced to rely upon appearances, usually without even the assistance of standardized methods of rating the teacher's fitness for the work. Since all this is true, it behooves the instructor of youth to endeavor to fulfil all the requirements of both supervisor and pupil, that she may be ranked as one of that noble company of ideal teachers of whom the published proceedings of educational associations are always full to overflowing.

Pupils' Estimates of Teachers Ranks and Percentages of Frequency

Qualities	150 Normal School Girls		253 High School Boys		139 High School Girls		Average Frequency
	Rank	Percent. Frequency	Rank	Percent. Frequency	Rank	Percent. Frequency	
Kindness.....	1	94	2	51	1	75	73
Fairness.....	2	54	1	56	5	44	51
Sociability.....	3	50	7	17	10	7	25
Sense of Humor...	4	45	5	22	4	47	38
Good Temper....	5	30	6	19	8	14	21
Discipline.....	6	23	3	35	2	52	37
Neatness.....	7	15	10	11	7	27	18
Patience.....	8	13	4	26	3	50	30
Preparation.....	9	11	8	15	9	14	13
Clearness of explanation....	10	0	9	15	6	43	19

CORRELATIONS

Normal School Girls
and
High School Girls

$$o_1 = 27$$

$$o_2 = 21$$

$$r = .88$$

$$P. E. = .05$$

High School Boys
and
High School Girls

$$o_1 = .15$$

$$o_2 = .21$$

$$r = .80$$

$$P. E. = .07$$

COMMUNICATIONS AND DISCUSSIONS

TRANSFER OF SPELLING VOCABULARY

In 1912-1913, the writer and four advanced students in education at DePauw University made a minor investigation regarding the transfer of spelling vocabulary. The problem specifically stated was, "To what extent do students use the accurate spelling vocabulary of their themes in English in themes in sociology?" Papers containing such themes were collected from the two departments concerned. Thirty students were found in the two courses for whom there were papers in both subjects. These students are indicated by number in the table following. For example, student 4 was represented by a theme in English and one in Sociology, for student 20, there was a theme in each subject, etc., etc. Thus it was possible to compare the work of the same individuals but in different types of themes. For example, it was possible to compare the manuscripts of student 4 in both subjects. It was the original plan to compare such themes as to several different matters such as writing, spelling, punctuation, etc. The comparison as to writing was made, but the resulting data have never been organized. The comparison as to spelling was made. The method used was as follows: The four students of education, hereafter known as Ni., Sand., Ay., and Pr., examined the same manuscripts. But they were not required to examine the whole manuscript, or the same portions of them. Ni. examined 5 pages of the manuscripts in English and sociology for student 7, while Sand., examined 4 pages for each theme for student 7. One examiner studied the same number of pages in the two themes as he examined them, but the pages were not necessarily the same pages examined by the others for the same themes. The numbers of pages actually examined are shown in the columns 2, 5, 8, and 11 of the following table. The English themes had been very carefully marked by the instructor of English and all misspelled words were indicated by red ink. No marks for misspelled words had been placed on the theme papers in sociology. The instructor in English had given even more than the usual stress to the necessity of accuracy in usage of spelling and other matters of elementary composition. The instructor in sociology had given practically no attention to the status of English in such themes, unless he found one in very inferior condition. The results of the

investigation are given entire in the following table. This table reads as follows: Ni. found one error in one page of English and one error in one page of sociology in the themes for student 4. Sand. found three errors in four pages of English and nine errors in four pages of sociology in the two themes written by student 8. Ay. found one error in five pages of English and three errors in five pages of sociology in the themes written by student 33. Pr. found the same facts for student 33.

RESULTS

No.	Ni.			Sand.			Ay.			Pr.		
	Pp.	Eng. Errors	S-Errors	Pp.	Eng. Errors	S-Errors	Pp.	Eng. Errors	S-Errors	Pp.	Eng. Errors	S-Errors
4	1	1	1	1	1	6	1	1	0	1	1	3
7	5	0	3	4	1	4	5	4	3	5	1	2
8	5	3	2	4	3	9	5	2	4	5	1	0
9	1	2	1	4	1	40	1	1	0	1	1	2
11	5	1	0	4	1	15	5	1	1	5	0	0
12	1	1	0	4	1	18	1	1	5	1	1	0
13	1	1	1	4	0	3	1	0	1	1	0	1
20	5	0	2	4	1	4	5	1	2	5	0	0
22	5	0	0	4	0	4	5	0	0	5	0	0
23	5	0	2	4	3	2	5	0	0	5	0	3
24	10	0	0	4	0	12	10	0	1	10	0	1
28	5	0	0	4	0	40	5	0	2	5	0	1
30	1	1	3	4	1	16	1	1	1	1	0	0
32	1	0	0	4	0	10	1	0	0	1	0	0
33	5	1	4	4	0	1	5	1	3	5	1	3
39	5	4	6	4	3	3	5	4	1	5	1	1
40	1	0	0	4	0	1	1	0	0	1	0	0
51	1	0	2	4	0	0	1	0	1	1	0	0
52	1	0	1	4	0	1	1	0	2	1	0	1
55	5	0	4	4	0	15	5	0	0	5	0	1
56	1	0	0	4	0	5	1	1	0	1	1	0
59	5	1	2	4	2	1	5	1	1	5	1	1
61	5	3	1	4	1	0	5	3	2	5	1	1
68	5	0	2	4	0	0	5	0	0	5	0	0
79	5	0	0	4	0	3	5	0	0	5	0	1
80	5	3	1	4	0	4	5	5	1	5	1	2
90	2	2	3	4	2	3	2	2	2	2	0	0
92	1	0	0	4	0	18	1	0	1	1	0	0
95	1	1	2	4	1	0	1	1	0	1	1	2
98	5	1	0	4	1	2	5	1	2	5	0	0
104	26	43	117	23	240	104	31	36	104	12	26	

From the above detailed table the following summaries in totals, averages, and percentages has been prepared.

No. of themes compared	No. of pp. compared	Errors—Misspelled words				Corrected totals	Averages
		Sand.	Ni.	Ay.	Pr.		
30 English.....	426	23	26	31	12	92	23.00
30 Sociology.....	429	240	43	36	26	245	61.25
Actual increase in errors in so- ciology themes.....		117	17	5	14	153	38.25
(After correction)							
Percentages of increase in errors							
(Corrected).....		519%	65.4%	16%	116.6%	166.3%	166.1%

The total number of errors found by Sand. in sociology themes is very much greater than the totals found by the other examiners. This was due to three factors: (1) Sand. counted each repetition of a misspelled word as an error. The others did not. (2) Sand. examined 13 pages more of manuscript than the other three examiners. (3) Sand. was much more accurate in discovering misspelled words for he had had more years of experience in general, several years' successful teaching experience, and had practiced to a considerable extent the detection of misspelled words. The others had not. The other three found an average of 35 errors in 104 pages, or one-third error per page. On this same basis, the total for Sand. would be 39 errors for 117 pages. A fair estimate of the increased number of errors found by Sand. due to his greater skill is judged by the writer to be one error per page. This would account for 117 errors, and would make the total for Sand. (39 plus 117) 156. This would make the error due to repetitions be about 84 (240-156). Probably this should be 100 rather than 84. It is held, then, that the total for Sand. is approximately 140 rather than 240. This is the correction referred to in the table above. On the other hand, it should be recognized that the unskilled examiners must have overlooked many misspelled words. If, then, our estimates for the total errors found by Sand. are too high, they would be counterbalanced to some degree by the inaccuracy of the others in the opposite direction.

There were then, approximately 160% more misspelled words in the sociology themes than in the English themes. *In other words, there was a very general tendency to lower the standard of efficiency in spelling used in the sociology themes.* In matters of punctuation and capitalization a beginning of a study was made. Here, too, a similar tendency was observed.

The writer believes that this minor study shows a very prevalent tendency in the effectiveness of the teaching of English in high schools and colleges, although the investigation made concerned college students only. As he interprets the situation, it represents a failure to

secure habits which transfer, or ideals which are consciously generalized. As such, it suggests the following: (1) teachers of English should strive to secure such transfer; (2) there should be a very much greater coöperation in the teaching of English. Had the instructor in sociology placed emphasis upon correct spelling, why should the students not have had a stronger tendency to spell correctly? (3) if such conditions exist as to spelling, the very *content* of one phase of the English language, what must be the conditions regarding the transfer of the more intangible elements of the mother tongue. It is probably easier to secure transfer of *content* than of some other elements. Hence, it is probable that many of the values of English are being realized only in a very minor degree.

A. R. MEAD.

Ohio Wesleyan University.

ABSTRACTS AND REVIEWS

ROBERT M. YERKES, JAMES W. BRIDGES, AND ROSE S. HARDWICK.
A Point Scale for Measuring Mental Ability. Baltimore: Warwick and York, Inc., 1915. Pp. 218. \$1.25.

What is the reason for the remarkable influence which the Binet-Simon scale for the measurement of intelligence has exerted on the educational thinking of the civilized world during the past five years? Such an instantaneous and general response to a psycho-educational mode of procedure challenges attention. Undoubtedly many factors have contributed to bring the Binet tests into prominence, but one of the most powerful is the conception of mental age. Chronological age has ever afforded the most convenient indication of physical and intellectual maturity. Moreover, it is generally recognized that in the young child increase of years brings with it increase of wisdom. Assuming that for each advancing year of chronological age there is a corresponding increment of intelligence, and assuming further that by selected groups of exercises we can detect these increments of intelligence, it becomes an interesting and important task to determine the mental age of individual children and to ascertain what tests are best fitted to reveal the degree of mental maturity. It is along these two lines that work with the Binet scale has progressed.

The authors of the present book refuse to accept the fundamental assumptions of mental age. By the calendar the interval between the fourth and fifth birthdays is equal to the interval between the fourteenth and fifteenth birthdays, but it is certain that the increments of intelligence are by no means the same. We have no evidence from the Binet tests or from any other source that the development of intelligence is regular. All that we know is that certain exercises are correctly performed by a considerable number of children of a given chronological age, that they are not so well performed by children of a lower age, and that children of a more advanced age show on the whole a higher percentage of correct responses. Moreover, the scoring of mental age by the Binet tests proceeds on the "all-or-none" principle, and entirely ignores qualitative differences. On these and other accounts the authors have rejected the mental age conception, and have devised a point scale consisting of twenty exercises, so weighted for quality of response as to give a maximum score of one hundred points. These exercises are taken almost exclusively from the Binet list, and all of them are given to each individual tested. The degree of intelligence is indicated by the number of points gained,

and is determined on the basis of norms derived from the examination of large groups of children of a particular type.

The book contains a description of the point scale and its construction, directions for its use, a comparison of the point scale with the Binet scale, the results of the application of the scale to more than seven hundred public school children, the derivation from these results of norms for age, sex, linguistic, and social status, a discussion of the limits of applicability of the scale and the reliability of the results obtained from its use, an account of the examination of 175 patients of the Psychopathic Hospital by means of the scale, suggestions for the revision of the scale on the basis of the results already obtained, materials and directions for the revised scale, and a brief discussion of the outlook for a universally applicable point scale for mental measurement. The point scale is claimed to be superior to the Binet scale in that, in addition to the arguments indicated above, "it is capable of giving results of ever-increasing reliability and precision as data accumulate and norms are established," whereas the Binet scale is fixed from the outset. The point scale minimizes the personal equation of the examiner, reduces the number of doubtful cases, works with a smaller amount of testing material, and is more readily extended to the testing of adolescents, and of persons exhibiting special forms of mental instability.

The fundamental idea of the point scale commends itself to the reviewer as sound and valuable. It is more flexible than the Binet method, and the results obtained are more amenable to statistical treatment. The extent to which it has been adopted in the short time that it has been before the public is evidence that it possesses elements of popular appeal. Nevertheless, the present point scale seems to be defective in two important respects. First, the twenty tests of the scale are taken, with one exception, from the Binet list. But it has been pointed out again and again in criticism of the Binet scale that there is no guarantee that these particular exercises are highly indicative of intelligence. Three of the tests, memory span for words, for digits, and for designs, are memory tests. But a child might be very intelligent, might indeed have a good memory for really useful types of knowledge, and yet make a poor showing in these isolated materials. The child who is unable to count backward from twenty is surely lacking in a certain type of intelligence, but it would seem that a child might perform this task and still be very unintelligent. In other words, we are woefully ignorant as yet about what constitutes intelligence, and about the kind of task that indicates the degree of its presence. Opposites tests and completion tests have been shown to correlate highly with intelligence as it is

ordinarily understood, but neither of these is included in the point scale list, and as to the diagnostic value of the tests found there we know little or nothing. A point scale on the basis of twenty tests each with a known degree of correlation with the common acceptance of intelligence would afford a starting point in which we might place some confidence.

In the second place, the distribution of points to the individual tests seems to be an entirely arbitrary proceeding. Each test is assigned from three to eight points, partly on the basis of the number of questions in the test, partly perhaps on an assumed relative difficulty of the test. But surely the ability to remember four digits is not to be compared with the ability to define "justice," yet each receives two points credit. Again, who knows the relative difficulty of remembering four digits and seven digits? The former is given two points credit, the latter five.

Some of those who have used the Binet scale have become so attached to it as to regard it with a sort of religious veneration, and consider supplanting it with something else almost a sacrilege. In the opinion of the reviewer the Binet scale is a rough, crude, clumsily constructed instrument, which has, nevertheless, served a most useful and valuable purpose in stimulating interest in mental measurements. The Yerkes point scale is an interesting and important step in the refinement of that instrument. But for a genuine, scientifically valid point scale we need much more extensive studies on the correlation of specific tests with various aspects of intelligence, and on the relative difficulty of these tests compared with each other.

J. C. B.

IRVING FISHER AND EUGENE LYMAN FISK. *How to Live*. New York and London: Funk & Wagnalls Company, 1916. Pp. xxiii, 345. Cloth, \$1.00; linen, \$0.50.

Here is a remarkable book that should be in every school library and in the hands of teachers and parents where possible. It is the latest authoritative pronouncement and an outline guide in hygiene gotten up by the Life Extension Society for the purpose of lengthening life and making it more wholesome. Today it is the hand-book of preventive medicine. This book is the ounce of prevention which is worth a pound of cure.

"Thoroughly carried out, individual hygiene implies high ideals of health, strength, endurance, symmetry and beauty; it enormously increases our capacity to work, to be happy, and to be useful; it develops not only the body, but the mind and the heart; it ennoble the man as a whole."

C. E. S.

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EDITORIAL

As the JOURNAL OF EDUCATIONAL PSYCHOLOGY enters upon its eighth year there is satisfaction in noting that the cause for which it has consistently stood, the application of experimental methods of investigation to educational problems, is held in increasing esteem by the educational public. To boast of the influence it has wielded in furthering the experimental movement would be unbecoming, but the number of references to its pages in current text-books and general treatises is conclusive evidence that it has rendered important service as an avenue of expression to those who are engaged in productive work in education.

The past year has been characterized by especial activity in the applications of psychology to business and vocational education. The establishment of the Bureau for Salesmanship Research at Pittsburgh under the direction of Scott, Bingham and Whipple, the work of Woolley at Cincinnati, Adams at Michigan, Hollingworth and

others at Columbia, and the propaganda of Muensterberg of Harvard, so suddenly struck down in his prime, bear witness to the interest which this type of investigation arouses. The new *Journal of Applied Psychology*, soon to be launched at Clark University, will doubtless quickly win recognition as the leading organ of publication for studies of this sort, and we shall gladly extend a hearty welcome to our youngest sister in the family of psychological periodicals.

In mental tests noteworthy progress has been made during the past year in two directions. First, our knowledge of psycho-motor activity has been enriched and extended by Wallin and Dearborn in their modifications of the form board and the establishment of norms of performance in its use, while Kelley in his constructive ability test has opened up a new field for the quantitative estimation of inventive capacity. Secondly, measurements of general intelligence have been greatly advanced by Yerkes and his co-workers on the point scale, by Terman in his thorough-going revision of the Binet scale, and by Saffiotti in his summary of the work which has been in progress for several years in Italy. It might justly be said that there is no department of psychology or education in which there is more valuable productive work going on than in measurements of intelligence.

In the narrower domain of education Starch has endeavored to bring together the scattered contributions to educational measurements, and Freeman has offered stimulating and helpful suggestions in his *Psychology of the Common Branches*, and his laboratory manual in *Experimental Education*. Contributions to the study of reading have been made by Thorndike and W. S. Gray, of writing by C. Truman Gray, of grammar and arithmetic by Starch, and of spelling by Otis. Perhaps the most interesting feature in experimental education has been the manifestation of tentative efforts in high school subjects. Here preliminary studies have been made by Monroe and Rugg in algebra, by Stockard and Bell in geometry, and by Hanus in Latin, and while none of these has yielded definitive results, trails have been blazed for further exploration.

For the coming year the JOURNAL OF EDUCATIONAL PSYCHOLOGY will publish a limited number of articles on general mental tests, measurements of intelligence, physiological studies, and aspects of the learning process, but in so far as possible the chief emphasis will be laid on experimental studies of behavior in school subjects. Articles are already on hand or in prospect on problems in reading, spelling, United States history, physics and chemistry, and readers of the

JOURNAL are invited to correspond with the managing editor if they know of studies of this sort which might be available. It will be the policy of the JOURNAL to give preference to articles that bear directly upon educational procedure, and to foster in every possible way the extension of experimental investigation to all phases of school work.

The meetings of the American Psychological Association and Section L (Education) of the American Association for the Advancement of Science, at New York City, December 27-30, were full of interest for the scientific student of education. So numerous were the offerings of

THE NEW YORK MEETINGS

papers to the Psychological Association that parallel programs were arranged for several of the sessions, much to the vexation of those who desired to hear papers scheduled for different rooms at the same time. The division was made on the lines of pure and applied psychology, and in point of number and variety of papers presented, attendance at the meetings, and apparent eagerness to hear the subjects discussed the applied psychology sections seemed to be the most favored.

Papers of significance to educational psychologists were The Control of Accuracy of Movement, K. S. Lashley; Positive and Negative Perception and Recognition, Garry C. Myers; The Effect on Learning of the Length of Periods of Rest, Helen B. Hubbert; Experimental Studies in Memory, Edith F. Mulhall; Alleged Elements of Waste in Learning a Motor Problem by the Part Method, L. A. Pechstein; The Evaluation of a Method of Finely Graduated Estimates of Abilities, J. B. Miner; A Dissected-Story Test, Kate Gordon; A Graded Series of Dove-Tail Puzzles, Grace Helen Kent; Group Tests for Preliminary Mental Surveys of Institutions and Schools, Rudolf Pintner; The Mental Level of a Group of Immigrants, H. H. Goddard; Experiments in Vocational Selection, W. D. Scott; An Application of Standard Measurements of Achievement in School Work to a Group of Delinquent Women, Mary A. Clark; The Relative Value of $6\frac{1}{2}$ vs. $4 + 2\frac{1}{2}$ Minutes in Learning a Page of History, A. S. Edwards; Notes on the Use of Certain Binet and Related Tests on College Students, Elsie Murray; Mentality Testing of College Students, W. V. Bingham; University Instructors Tested by the Stanford Scale, June E. Downey; A Detailed Study of Whipple's Range of Information Test, J. C. Bell; Point-Scale Coefficients of Intelligence, R. M. Yerkes; The Weighting of Point-Scale Tests, Rose S. Hardwick; Diagnostic Value of Some Mental Tests, Carl C. Brigham; "Scattering" in the Binet-

Simon Tests, E. A. Doll; Some Differences between Normals and Defectives not Indicated by Intelligence Tests, Florence Mateer; Comparison of the Binet-Simon Scale (1911) with the Stanford Revision and the Yerkes-Bridges Point-Scale as Given to Delinquent Women, Mabel R. Fernald and Mary H. S. Hayes; A Study of Tests Additional to those of the Binet Scale as Given to Delinquent Women, Mary H. S. Hayes and Mabel R. Fernald; and The After-History of Fifty Delinquent Girls, H. H. Goddard.

Of especial promise was the report made by J. B. Watson on his opportunities and plans for studying the reflex and other native equipment of newly-born infants. We have had many sporadic observations of the behavior of the newly-born, but comparative, experimental studies have been lacking. Dr. Watson's laboratory chances to be situated adjacent to a lying-in hospital and he is able to gain access to thirty or forty newly-born infants a week. Many of these he will be able to follow through the whole of the first year or longer. He has already demonstrated that practically every infant exhibits the reflex clasp under the proper conditions, and that with many infants this is so strong as to sustain the whole weight of the body by a single hand. He is making careful, quantitative studies of this and other forms of behavior which will be of the greatest importance for our understanding of the human organism.

Another event of peculiar interest was the celebration of the twenty-fifth anniversary of the founding of the American Psychological Association. Papers were presented by G. Stanley Hall, who was the leading spirit in the organization of the Association; by J. McKeen Cattell, who characterized in brilliant and witty phrase the chief tendencies in psychological research during the past twenty-five years; by Joseph Jastrow, another member of the original group at Johns Hopkins, who, paraphrasing James, described some "Varieties of Psychological Experience" which he had observed in the last quarter century; and by John Dewey, another member of the same group, who voiced the need of carrying the methods of present experimental psychology over into social psychology, and breaking with the schematic theories of social instincts that have reigned supreme in this field since the days of Tarde. This series of papers was felt as a great inspiration by all who were present, and they are heartily commended to the attention of the readers of the JOURNAL when they appear in print.

The general subject for the meetings of Section L. was "The Scientific Study of Educational Problems," and the papers gave evidence

of the increasing activity in the experimental investigation of education all over the country. Each session had nine or ten papers scheduled, and as a result there was little or no time for discussion. Lack of space precludes individual mention of important papers. Those that appealed most strongly to the writer were Fred S. Breed's and M. R. Trabue's studies with composition scales and H. A. Brown's and V. A. C. Henmon's investigations of ability in Latin. Instead of announcing Professor Thorndike's paper on "The Reliability of Certain Educational Tests" Vice-president Leonard P. Ayres said, "It is a well-recognized fact that educational psychologists in America are divided into two great classes." After a pause, during which everyone wondered what the nature of the classification would be, he continued, "We shall now listen to the *whole* of the first class." The audience appreciated the tribute and responded with hearty and prolonged applause.

Professor Robert M. Yerkes, of Harvard University, was elected president of the Psychological Association for the ensuing year, and Professor Edward Franklin Buchner, of Johns Hopkins University, vice-president of Section L.

Announcement has been made that with the financial support of the General Education Board an experimental school will be opened by Teachers College, Columbia University, in the fall of 1917. Professor Otis W. Caldwell, of the University of Chicago, will be the director of the school, and becomes a member of the faculty of Teachers College, of which the new school is a part. This organization ensures the coöperation in and the careful oversight of the workings of the school by the faculty of Teachers College, and thus provides a source of helpful and constructive criticism for all of the experiments undertaken. "In the curriculum, modern languages will be stressed and experiments will be made with a view to determining what methods of teaching English, French and German give the most substantial practical results. New methods of teaching literature, history and civics will be tried, and in this connection efforts will be made to ascertain whether the important ancient classics cannot be effectively used in translations. Latin and Greek as languages will not be taught in the school. Science, industry and the domestic arts will be prominent throughout the school, and increased attention will be given to music, drawing and art. The subject of mathematics will receive

special consideration in the hope of working out a rational course of study which connects the study of mathematics with its use, and which also makes adequate provision for those who have special ability or desire for this subject. The school will frankly discard that theory of education known as 'formal discipline' and will undertake to secure training through the careful and thorough study of subjects which are in themselves valuable. It is believed that a much more effective discipline can be thus secured." The tuition fees will be moderate, and many parents have already signified their desire to have their children enrolled next fall.

This enterprise is of the greatest significance and of the highest importance for education in America. From such a school, established under the most favorable auspices of financial support, of administrative control, and of broad-minded, liberal policy, we may expect scientifically substantiated answers to many of the vexed problems of method and of the study of school subjects, which at present rest solely on tradition and opinion. But most important of all it ought to furnish many object lessons to educators as to how an educational experiment should be set and controlled. Unfortunately to this day few supervising officers and almost no teachers understand what an educational experiment is. Many of those high in authority still metaphorically cross themselves whenever experiment is mentioned in connection with the schools. Under the enlightened direction which this school will have we assume that it will be a genuine experimental school, not merely a demonstration of some one's pet scheme; that it will select certain problems that are amenable to experimentation, clearly define each problem, and so arrange conditions as to provide the clearest and most definite controls and checks on the reliability of the results. In other words this school ought to be for educational practice what the Rockefeller Foundation for Medical Research is for medical practice.

With this beneficent and most desirable end in view one is astounded that so progressive and enlightened a newspaper as the New York Times should appear with a two-column editorial branding the undertaking in the most denunciatory terms as "radical and dangerous." After quoting the purposes and aims of the school somewhat more fully than we have given them above and referring to Dr. Flexner's pamphlet "The Modern School," the writer indulges in the following amazing diatribe: "This is bread and butter education and nothing else. In the General Board's program and in the course of study

there is not a trace of anything tending to the development of character. There is nothing that would lead us to suppose that the graduate of the 'modern school' would have in his mind any ideas, any general ideas, any ideas at all above or outside the realm of his daily tasks. . . . We make bold to say that young men and women trained in this manner would be as destitute of culture as a Hottentot. Imagination will be cramped and stunted, knowledge and enlightenment abridged and shorn of those intellectual pleasures and satisfactions which make them a rich possession. . . . Unblushing materialism finds its crowning triumph in the theory of the modern school. In the whole plan there is not a spiritual thought, not an idea that rises above the need of finding money for the pocket and food for the belly. There is nothing that would implant in the mind of ingenuous youth the thought that there was anything worth while outside the shop, the market, and the laboratory; that of the vast accumulations of human thought any part is worth preserving save that which directly relates to making a living." And so on for two columns.

What is one to think of this? How are we to account for such an outburst of fury in response to the simple invitation "Let us prove all things educational, and hold fast to that which is good?" What a monstrous example it is of the mental bias engendered by the blind following of tradition! What better proof could there be of the need for an experimental school to show people of presumed intelligence what an educational experiment signifies?

J. C. B.

NOTES AND NEWS

The following program has been arranged for the meeting of The National Association of Directors of Educational Research at Kansas City, March 1: "The Problem of Measuring Ability to Read Silently," S. A. Courtis, Detroit, and H. W. Anderson, Dubuque, Iowa; "Correlation between Ability to Think and Ability to Remember, with Special Reference to United States History," B. R. Buckingham, Madison, Wis.; "Organized Effort in Educational Research in City School Systems," J. P. O'Hern, Rochester; "Fundamental Problems of Educational Research from the Point of View of a State Bureau," Charles Fordyce, University of Nebraska, F. J. Kelly, University of Kansas, and H. A. Brown, Concord, N. H.

Under the auspices of the Economic Psychology Association a conference was held at the Columbia University psychological laboratory, January 26 and 27, on the topic "The Human Element in Business." Several applied psychologists and many employers of labor participated in the conference.

Dr. James R. Angell, of the University of Chicago, is giving a course of lectures on "The Makers of Modern Psychology" on the Spencer Foundation at Union College.—*Science*.

Dr. Maria Montessori has been spending the past few months in New York City conducting courses at the Montessori Normal College, which was opened at 144 West 74th Street, New York City, last fall. She has also delivered several public lectures in various cities of the East.

At Harvard University Raymond B. Fosdick is giving courses in police administration, including the keeping of records, identification systems, and the psychology of the interrogation of persons arrested.

Last fall a survey was made of the San Francisco public schools by the staff of the United States Bureau of Education, assisted by John W. Withers, of St. Louis, Charles McMurry, and Fletcher B. Dresslar, of Peabody College, Nashville, and J. Stanley Brown, of Joliet, Ill.

Owing to the interest manifested in the work of the University of Missouri Elementary School by superintendents and teachers who expect to attend the meetings of the Department of Superintendence at Kansas City, and who wish to observe the school in session, arrangements have been made to hold school on Saturday, February 24, and on Saturday, March 3, as well as on the regular school days of the intervening week. Visitors to the school will be cordially welcomed.

On account of many requests for his first "Study of Mental Fatigue in Relation to the Daily School Program," (1913), Dr. W. H. Heck, of the University of Virginia, has recently obtained a few more cloth-bound copies, and will send them on request to libraries and to professors of education.

Professor Alfred L. Hall-Quest, of the University of Virginia, author of "Supervised Study," delivered a series of lectures on supervised study before the Teachers' Association of Rochester, N. Y., early in November. As a result the principal and teachers of the Washington Junior High School of that city have begun an extensive experiment to determine the effectiveness of study supervision.

Professor E. A. Kirkpatrick, of the Fitchburg, Mass., State Normal School, is spending the year as exchange professor at the Bellingham State Normal College, Washington.

Professor Theodule-Armand Ribot, well known in this country for his books on various aspects of psychology, died in Paris on December 8, at the age of seventy-seven years.

On December 16 Professor Hugo Muensterberg, of Harvard University, died suddenly while giving a lecture to his class at Radcliffe College. Professor Muensterberg published several volumes of contributions to psycho-physics at the University of Freiburg, and in 1892, at the suggestion of William James, was invited to come to America as director of the psychological laboratory at Harvard University. A few years later he took a very positive stand against certain questionnaire studies in psychology and education, which were very popular at the time, and for many years he was thought by school men to be hostile to educational psychology. In 1909, however, he showed in his book "Psychology and the Teacher" his hearty sympathy with experimental studies in education as carried on by Meumann, Stern, Thorndike and others, and he evinced a keen interest

in the foundation of the JOURNAL OF EDUCATIONAL PSYCHOLOGY. In recent years the bulk of his writings dealt with the application of psychology to law, medicine, industry, and social affairs, and his last large work in German was entitled "The Elements of Psychotechnics."

Dr. Naomi Norsworthy, associate professor of educational psychology in Teachers College, Columbia University, died on December 25, 1916. Dr. Norsworthy was an acute, penetrating thinker, an inspiring and broad-minded teacher, and a genial and sympathetic personality.

Dr. Helen M. Hubbert, adjunct-professor of philosophy and education at Randolph-Macon Woman's College, has returned to her work after a year's leave of absence.

Dr. Joseph K. Hart, formerly professor of education in the University of Washington, has been appointed professor of education at Reed College, Portland, Oregon. Dr. Hart is giving an extension course on "The Principles of Vocational Education." Another extension course on "Psychology applied to Business" is being given at Reed College by Dr. Ernest H. Lindley, head of the department of philosophy and psychology at Indiana University.

Mr. Alfred E. Rejall, formerly instructor in psychology in the New York State Teachers College at Albany, has been appointed instructor in education at Boston University.

Louie Winfield Webb, Ph. D. (Chicago), has been appointed instructor in psychology and education, and Willis Lemon Uhl, M. A. (Northwestern), has been appointed instructor in education at Northwestern University.

Wilbur H. Norcross, graduate student in psychology at the Johns Hopkins University, has been appointed associate professor of philosophy, psychology and education in Dickinson College, to fill the vacancy left by the death of Professor W. L. Gooding.—*School and Society*.

Dr. Elizabeth Woods some time ago resigned her position as assistant professor of psychology at Vassar College to become director of Child Welfare in Pasadena, California.—*Jour. Phil., Psych., and Sci. Meth.*

PUBLICATIONS RECEIVED

FREDERIC D. BARBER, MERTON L. FULLER, JOHN L. PRICER, AND HOWARD W. ADAMS. *First Course in General Science*. New York: Henry Holt and Company, 1916. Pp. vii, 607.

There is an increasing appreciation of the need of greater emphasis on natural science in our educational procedure, but also a recognition that the present methods of teaching science in the high school fail to meet that need. From this recognition has grown the demand for a general introductory course in science, which shall awaken the interest of pupils, give them some inkling of what may be expected in further work in science, and prepare for later intensive study of the special sciences. Many think that the best line of attack is through the biological sciences. The present authors prefer the physical environment. They consider first the production and use of light, then heat, refrigeration, the weather, the seasons (climate and health), ventilation, food and nutrition, micro-organisms, soil, water supply, sewage disposal, machines, work, and energy. Throughout the book utility to man is the essential criterion of selection. There is an abundance of excellent illustrations, a liberal use of simple graphic representations, and a rich array of the results of scientific investigations. With a good teacher such a text should arouse a high degree of interest in young people, and should make them much more familiar with their environment than the average man is.

GEORGE ALBERT COE. *The Psychology of Religion*. Chicago: The University of Chicago Press, 1916. Pp. xvii, 365. \$1.50.

The author is frank in giving at the outset the personal attitudes that were influential in shaping the treatment of the subject. "It is socially desirable that 'an ideal socius' (God) should exist." The religious enterprise is the most important undertaking in life. Every religious experience is a datum to be examined analytically, and not to be referred to any dogmatic authority. Deep religious conviction does not involve mysticism, nor does it invalidate the accuracy of one's psychological thinking. The origin of the God-idea is found in man's organic and social need to see in the world about him a manifestation of the same sort of activity that he feels within him. Religion in all its forms is essentially the consciousness of relationship with this "ideal socius." The book presents interesting studies of conversion, the traits of religious leaders, religion and the subconscious, mysticism, the future life, prayer, and the religious nature of man. Since the whole trend of civilization is to increase the scope and solidarity of social relationships the author finds that the power of religion is waxing rather than waning. This may be true psychologically without in any way invalidating the conclusion that the historical forms of religion have far less influence than they had a generation ago.

HARRIET M. JOHNSON. *The Visiting Teacher in New York City*. New York: Public School Association, 1916. Pp. xv, 84.

The sub-title of this report is "A statement of the function and an analysis of the work of the visiting teacher staff of the Public Education Association from 1912 to 1915 inclusive." The visiting teacher is the connecting link between the school and the home. If a pupil is reported as failing in a particular subject, or is habitually late, or troublesome in the conduct of the school, the case is reported to the visiting teacher for investigation and treatment. The monograph gives a clear and moving account of the work of the visiting teacher, with many illustrative cases. It contains more social psychology in relation to educational problems than is usually found in such reports, and raises many serious questions in regard to the functions of the school in its relation to the community.

HARRY D. KITSON. *How to Use Your Mind*. Philadelphia: J. B. Lippincott Company, 1916. Pp. 216.

This book is intended by the author as "a psychology of study, being a manual for the use of students and teachers in the administration of supervised study." It is designed for high school students, or even for the upper elementary grades when properly interpreted by the teacher. It contains advice on such topics as note-taking, formation of study-habits, memorizing, concentrating attention, reasoning, self-expression, getting off plateaus, finding a mental second-wind, and securing the best bodily conditions for effective study. The author's intentions are excellent, but the language is somewhat pedantic, the statements about physiology are sometimes misleading if not quite erroneous, and the discussion seems rather thinly spread over a large number of pages. A simpler and more compact style would have added much to the value of the book.

CALVIN L. LEWIS. *A Handbook of American Speech*. New York: Scott, Foresman and Company, 1916. Pp. 246.

This is another book designed for training in oral English, and stands out from others in its emphasis on voice production. The first fifty pages deal with the physiology of voice production, and present many illustrative plates and exercises for voice training. The treatment is synthetic, combining sounds into words, words into sentences, and sentences into arguments. There are seventy pages of carefully chosen selections for practice.

MARY E. MOXCEY. *Girlhood and Character*. New York: The Abingdon Press, 1916. Pp. 400. \$1.50.

Another book on girls! Yes, but this one is different. In the first place it is evidently written by one who is familiar with the literature of biological and experimental psychology, and who does not hesitate to apply that knowledge to the concrete situations of the discussion.

In the second place, while the author evidently knows her psychology, she has not attempted to write a psychological treatise, but has taken the problems that arise in the development of the girl and has tried to interpret and explain them to the parent or friend who is interested in her behavior. Above all there is a wholesomeness and sanity, a tone of sweet reasonableness pervading the entire discussion, that makes it stand out in sharp contrast to most "books on girls." There are four parts, the first dealing with childhood and pre-adolescence, and the others with early, middle, and late adolescence. The book is worth the careful attention of those who are interested in girls.

GARRY C. MYERS. *Incidental Perception*. Reprinted from the *Journal of Experimental Psychology*, 1: No. 4, 1916, 339-350.

The accuracy of incidental perception of time, size, and weight was only slightly less than in purposive perception. Time was overestimated, while size and weight were underestimated.

WILLIAM HENRY PYLE. *A Manual for the Mental and Physical Examination of School Children*. The University of Missouri Bulletin, Vol. 17: No. 24, 1916. Pp. 32.

This bulletin is a simplification and condensation of the author's *Examination of School Children* designed for the use of teachers. The tests are logical memory, rote memory, substitution, free association, opposites, word building and completion. In logical memory new and simpler selections are used, the stimulus words in the rote memory tests are rearranged, new and more extended lists of opposites are given, and the completion tests are added. The latter are composed of simple selections, the sources of which are not indicated. Tables and graphs of norms are presented, but there is nothing to show how these norms were secured, or upon what range and type of investigations they are based.

FRANCES ELLIS SABIN. *The Relation of Latin to Practical Life*. Madison, Wisconsin: Published by the Author, 1916. Pp. 124.

Whatever may be thought about the desirability of encouraging high school pupils to study Latin, all will agree that if Latin is taught it ought to be taught as effectively as possible. This little volume will be of great assistance to teachers in vivifying the study of Latin, in connecting it with the things that pupils think are worth while, and in making them appreciate the extent to which modern languages, modern literature and modern science have borrowed from the Latin. In a series of chapters constructed with the idea of putting the salient features on large cards for class display the author illustrates the value of Latin in enriching the meaning of English words, in grouping English words about Latin roots, in helping to spell, in understanding abbreviations, in appreciating references to classical literature, in studying Romance languages, in mastering scientific terms, and in

grasping the full significance of many terms commonly used in law, medicine, engineering, architecture, and business. The wide-awake teacher can extend the list indefinitely, and can thereby arouse a lively interest in her subject.

F. UMBERTO SAFFIOTTI. *La Misura dell' Intelligenza nei Fanciulli*. Rome: Societa Romana di Antropologia, 1916. Pp. viii, 286. Lire 6.

This elaborate and painstaking work on "The Measurement of Intelligence in Children" comes from the laboratory of the Institute of Anthropology and Experimental Psychology at the University of Rome, which is under the direction of Giuseppe Sergi. It will be remembered that Treves and Saffiotti were among the first to try the Binet-Simon tests and in 1910-12 published several reports on them and proposed various improvements. In this work the author gives a comprehensive survey of the history and present status of mental testing, discusses in detail the applications of the Binet tests, and in the last hundred pages develops the method of Treves-Saffiotti and illustrates its use by comparing the results obtained by it with those from the Binet tests. There is a bibliography of 603 numbers. The book is an important contribution to the subject of mental testing, and deserves careful study at the hands of all workers in the subject. Unfortunately the author does not include in his discussion any reference to the Yerkes Point Scale or Terman's recent work (they are mentioned in the bibliography), and the fact that he has depended largely upon Meumann rather than upon original sources for his knowledge of American studies has led him into some curious errors.

CARL E. SEASHORE. *Vocational Guidance in Music*. University of Iowa Monographs, First Series, No. 2, 1916. Pp. 11.

This bulletin announces the establishment of the Psychology of Music Studio, a branch of the psychological laboratory of the University of Iowa, for the scientific study of musical aptitudes according to the plans outlined in the author's *Psychology in Daily Life*. The bulletin indicates the nature of the tests, gives a number of musical talent charts, states the conditions under which a professional musical examination will be made, and outlines a plan for music surveys in the public schools.

ROBERT L. SHORT AND WILLIAM H. ELSON. *Introduction to Mathematics*. New York: D. C. Heath and Company, 1916. Pp. vii, 200.

"This book employs the increasingly popular correlated method, combining related portions of arithmetic, algebra, and geometry. It treats these branches of mathematics more with reference to their unities and less as isolated entities (sciences)." The book is built upon the equation, and both arithmetical and geometrical problems

are to be solved by equations. There is an abundance of problems, which the considerate teacher will doubtless use sparingly and with discretion.

BORIS SIDIS. *The Causation and Treatment of Psychopathic Diseases.* Boston: Richard G. Badger, 1916. Pp. 418. \$2.50.

"Psychopathic diseases are not hereditary, they are acquired characteristics." Such is the challenge with which this book opens. It is true that such acquisitions are possible only on the assumption of an exceptionally sensitive nervous system, but the author contends that the disturbance itself is no more inherited than the susceptible patient inherits smallpox or diphtheria. In the book we find a discussion of psychopathic reflexes, the fear instinct, the laws of recession and reversion, the impulse of self-preservation, and the psychopathic substratum. The author lays great weight on the method of hypnoidization in the treatment of psychopathic disturbances and savagely attacks the eugenists for willful perpetuation of error in ascribing mental instability to heredity. "The value of the hypnoidal state for the treatment of psychopathic affections is in the lowering of the high thresholds, and in the formation of associations with utilization of accumulated stored-up energy requisite for the restoration of the higher psychic functions, for the exercise of the voluntary and personal control over the dissociated, automatically or subconsciously functioning groups of systems."

HENRIETTA BROWN SMITH, Editor. *Education by Life. A Discussion of the Problem of the School Education of Younger Children.* Baltimore: Warwick and York, 1916. Pp. viii, 211. \$1.25.

This book is a collection of articles by eminent English teachers on such topics as the personality of the teacher, religious training, health, literature, handwork, music, games, nature study, number, reading, writing, history and geography. The primary teacher will find many valuable hints and suggestions in the book.

DANIEL STARCH. *Educational Measurements.* New York: The Macmillan Company, 1916. Pp. vii, 202. \$1.25.

As the first attempt to bring together the widely scattered work on educational scales and measurements this book will attract the attention of educational investigators, superintendents and teachers. A brief introductory chapter on the significance of educational measurements is followed by a consideration of the reliability of school marks, particularly marks in English, mathematics and history. Here the author draws chiefly upon his own published studies and shows the wide distribution of teachers' marks on the same test paper. A survey of the marking system in a single high school shows great inequality in the marking standards of different teachers. A five-step marking scale and a closer approximation of the marks to the normal distribution are recommended. In succeeding chap-

ters the following scales and tests are presented; the Starch, Thorndike, and Kelly reading tests; the Thorndike and Ayres writing scales; the Starch, Ayres, and Buckingham spelling lists; the Starch grammar scales; the Starch and Courtis arithmetic tests; the Hillegas-Thorndike and Harvard-Newton composition scales; the Thorndike drawing scale and the Rugg lettering scale; and a series of tests suggested by the author in Latin, German, French, and physics. To the student of educational measurements the book is distinctly disappointing, in that an inordinate amount of space is given to the presentation of the tests themselves (frequently in unnecessarily large type), while there is almost a complete absence of discussion of the derivation of the tests, there is scarcely any mention of the results of their application, and there is no critical or constructive comment of any sort. It is a mere collection of test materials, rather than a scientific contribution to educational measurements.

HANNIS TAYLOR. *Cicero: A Sketch of his Life and Works*. Chicago: A. C. McClurg and Company, 1916. Pp. xiv, 615. \$3.50.

This splendid work is not merely a biography of Cicero, the man, but it is rather a scholarly, broad-minded, philosophical portrayal of the closing years of the Roman republic, "a commentary on the Roman constitution and Roman public life." The author is eminently fitted for the task he has chosen. His studies on the English and the American constitutions and on international law have given him a background of comparative government which it would be hard to equal, and have furnished him with an incomparable equipment for the interpretation of Roman life to modern thinkers. But it is not for its ripe scholarship and its broad scope alone that the book is to be commended. The lucidity and simplicity of the narrative, the dramatic power with which the persons and events are presented, the vividness and distinctness with which the political intrigues of the time are painted make the narrative as enthralling as a romance. Every teacher of Latin or of Roman history, and every one who is interested in that momentous governmental revolution from the Roman republic to the empire should have this book at hand for reference.

LEWIS M. TERMAN. *The Measurement of Intelligence*. Boston: Houghton Mifflin Company, 1916. Pp. xviii, 362. \$1.50.

The sub-title of this book is "an explanation of and a complete guide for the use of the Stanford revision and extension of the Binet-Simon Intelligence Scale." For some time the initiated have known of the work on tests of intelligence that was going on at Stanford University. Many have spoken of it as the most extensive and most carefully conducted investigation of intelligence tests that has ever been undertaken. Here we have the first publication regarding it. It is true that we shall not find in this book the statistical presenta-

tion of the results of that investigation. The scientific report, which is eagerly awaited by advanced students of mental testing, is reserved for a subsequent volume. The present book is a popular and untechnical discussion of the general principles of mental testing, and furnishes a guide for the practical conduct of the tests by teachers, physicians, and social workers. It is also intended as a text in normal schools, colleges, and teachers' reading circles. It will be seen that the author does not share the disinclination expressed by many psycho-clinicians to countenance the use of measuring scales by those untrained in technical psychology. "While the use of the intelligence scale for research purposes and for accurate diagnosis will of necessity always be restricted to those who have had extensive training in experimental psychology, the author believes that the time has come when its wider use for more general purposes should be encouraged." The book is in two parts. Part I discusses the uses of intelligence tests, the sources of error in judging intelligence, the Binet method, the nature of the Stanford revision, the significance of intelligence quotients, and the reliability of the Binet method. Part II is a detailed guide for the administration of the scale with specific directions for giving and scoring each question.

GUY MONTROSE WHIPPLE. *How to Study Effectively*. Bloomington, Illinois: Public School Publishing Company, 1916. Pp. 44. Fifty cents.

This little book is the result of the request of a group of high school pupils for advice on the technique of studying. "A survey of the available literature seemed to warrant the conclusion that, despite the existence of a number of books upon the art of study, there was still room for another treatment that should be limited to the direct laying down of a series of rules or maxims, with just sufficient explanatory comment to make them readily intelligible and serviceable for the needs of the average high-school or college student." The book will commend itself to both teachers and pupils by its brevity and conciseness of statement. The rules are just thirty-eight in number, each printed in heavy black-faced type with a half-page to a page of comment. Some of the rules are: "Form a place-study habit." "Form a time-study habit." "Do your work with the intent to learn and to remember." "Get rid of the idea that you are working for the teacher." "Don't apply for help until you have to." "Before beginning the advance work, review rapidly the previous lesson." "Give most time and attention to the weak points in your knowledge or technique." "You must daily pass judgment as to the degree of importance of items that are brought before you, and lay special stress on the permanent fixing of those items that are vital and fundamental." "When drill or repetition is necessary, distribute over more than one period the time given to a specified learning." "In committing to memory a poem, declamation or oration, do not break it up into parts but learn it as a whole."

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A STUDY OF THE MEMORY OF YOUNG WOMEN

CEPHAS GUILLET

State Normal School, Westfield, Mass.

"In a child a good memory is well known by three properties, that is, if it be quick in receiving, sure in keeping, and ready in delivering forth again."—ROGER ASCHAM in *The Schoolmaster*, 1571.

In the State Normal School at Westfield, Mass., the present writer, who is in charge of the work done there in psychology, has conducted an investigation into the memory of two Junior classes. Eighty-two of the students in 1915, all of them young women admitted the previous fall from the High Schools, took all the experiments in three sections. Section A numbered 29 students, section BC 27 and section D 26. In 1916, 87 students of the new junior class took the same experiments, the sections now numbering 27, 32, and 28 respectively. The material was presented orally in series of ten units, was written by the class and then collected and examined by the investigator. Several days after the first presentation the series were presented again, and several days later the pupils were asked to recall them. In this third experiment in 1915 the pupils were given the first member of each series, except in the case of the continuous prose. In 1916 they were first to write it down from memory if they could, and it was counted only for those who so wrote it. The same was done in section D of the 1915 class. In 1916, 98 per cent. of the pupils recalled the first member in continuous prose, 95 per cent. the first related sentence, 90 per cent. the first related word, 79 per cent. the first unrelated word, 86 per cent. the first nonsense syllable, and 89 per cent. the first figure.

For 1915 the number of days that elapsed between the first presentation and the second, and between the second presentation and the active reproduction of the different series, is shown by the following table, in which the numbers 1, 2, 3, 4, 5, 6 stand respectively for figures, nonsense syllables, unrelated words, related words, related sentences and continuous prose.

First Presentation of 1, 2, 3, 4.....	19 Jan.
Second Presentation of 1, 2, 3, 4.....	21 Jan.
Reproduction of 1, 2, 3, 4.....	26 Jan.
First Presentation of 5.....	21 Jan.
Second Presentation of 5.....	26 Jan.
Reproduction of 5.....	4 Feb.
First Presentation of 6.....	11 Feb.
Second Presentation of 6.....	16 Feb.
Reproduction of 6.....	18 Feb.

In 1916 the second presentation in all cases followed the first after an interval of four days, and the reproduction followed three days thereafter, all the material being used each day, namely, Jan. 3, 7 and 10.

The series of figures was 9417380562. The nonsense syllables were nar, toog, fap, gak, tum, neck, leb, qual, bast, pud. The unrelated words were air, when, up, sleep, past, canned, fray, cash, seat, mere. The related words were paint, green, grass, flowers, petals, yellow, faded, white, foam, fleece. Each of these series was presented in eight seconds and two minutes were allowed for the writing of them.

The related sentences were: 1. Time is money. 2. The love of money is the root of much evil. 3. Evil is the opposite of good. 4. The good alone are truly happy. 5. Happy are they who do what they know to be right. 6. Right action brings its own reward. 7. The wages of sin is death. 8. By sin came death into the world. 9. All the world loves a lover. 10. Love is the greatest thing in the world. These sentences took thirty seconds to read, and the pupils were allowed four minutes to write them.

The continuous prose was as follows: (1) Cicero $\frac{1}{8}$ was born $\frac{1}{8}$ at an obscure $\frac{1}{8}$ country town $\frac{1}{8}$. (2) His family $\frac{1}{4}$ was without wealth $\frac{1}{4}$, (3) yet $\frac{1}{8}$ he rose $\frac{1}{8}$ rapidly $\frac{1}{4}$, (4) until $\frac{1}{8}$ at the age of 46 $\frac{1}{8}$ he became $\frac{1}{4}$ consul. (5) In oratory $\frac{1}{4}$ he is placed $\frac{1}{4}$ side by side with Demosthenes $\frac{1}{8}$. (6) He surpassed $\frac{1}{8}$ the latter $\frac{1}{8}$ in brilliancy $\frac{1}{4}$, (7) but $\frac{1}{8}$ lacked $\frac{1}{8}$ his moral $\frac{1}{4}$ earnestness. (8) His delivery $\frac{1}{4}$ was impassioned $\frac{1}{4}$, (9) his voice $\frac{1}{4}$ strong $\frac{1}{8}$ and sweet $\frac{1}{8}$, (10) his figure $\frac{1}{4}$ tall $\frac{1}{8}$, graceful $\frac{1}{8}$ and impressive $\frac{1}{8}$.

Ten points were given for each series at each repetition of it, one point for each of the ten members. In the case of the figures a mark was given for a figure only when it was properly placed, that is to say, either in its proper rank or next after the figure that preceded it in the original series. In all the other series half was given for the correct unit and half for place. In the case of the nonsense syllables, if there was only one error, namely, the vowel or one of the consonants (initial or final) wrong, a quarter of a mark was allowed for the syllable and still a half for position. In the case of the continuous prose very few instances of disarrangement of order occurred. In marking the related sentences and continuous prose I had in mind correctness of thought rather than exact wording.

From the data I first made out a table of averages for the First Presentation (1 Pr.), Second Presentation (2 Pr.) and Reproduction or Delayed Recall (Rep.) of the six kinds of material, Figures 1 (Fig.), Nonsense Syllables (N. S.), Unrelated Words (U. W.), Related Words (R. W.), Related Sentences (R. S.), and Continuous Prose (C. P.), and for the two classes of material, Unrelated (U. M., the first three kinds) and Related (R. M., the last three kinds), also for the total number of marks obtained (M.). In some cases, besides the average, the maximum (Max.) and minimum (Min.) marks obtained are given. The greatest number of marks possible is also indicated.

TABLE OF AVERAGES
1915

Possible 10										Possible 30		Possible 60		Possible 90		Poss. 180																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Figures		Nons. Syl.		Unr. Words		Rel. Words		Rel. Sent.		Cont. Prose		Unr. Mat.		Rel. Mat.		All Mat.		All Three Experiments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	Fig.	N. S.	U. W.	R. W.	R. S.	C. P.	U. M.	R. M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
6.1	7.9	4.1	3.8	5.2	3.3	5.7	6.7	3.5	7.7	8.2	7.3	4.4	5.7	3.9	5	7.2	6.6	15.6	19.7	10.7	17.1	21.2	17.9	32.6	40.9	28.7	18.1	12.3	15.9	23.2	14	18.8	45	55.9	100.9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
6.9	8.4	3.5	3.1	4.8	3.4	5.5	6.9	3.8	6.5	8.1	6.5	4	6.2	3.9	5.6	7.5	7.1	15.5	20.1	10.5	16.1	21.9	17.3	31.1	54.1	49.8	18.8	11.3	16.2	22.1	14.1	20.2	46.7	55.1	101.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
BC	6.7	8.4	3.5	3.8	5.4	3.5	6.2	7.3	3.9	6.6	9	7.4	4.1	5.5	3.2	4.8	6.7	5.9	13.7	21.3	11	15.5	21.6	17.3	32.2	44.2	29.8	18.6	12.7	17.4	23	12.8	17.4	48.9	50.3	102.3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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All	10	10	9	9	9.5	9.2	9.5	8	10	10	10	7	9.7	8.7	9.7	10	9.7	10	24.5	23.2	23.2	23.2	23.2	23.2	44.2	55	46.7	44.2	55	46.7	44.2	55	46.7	44.2	55	46.7	44.2	55	46.7																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Max.	1	3	0	0	1.5	1	3	4.2	0	2.7	4	.5	1.7	2.5	1	2	3.2	3	9	11	11	11	11	11	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.2	23.2	22.5	24.

1916

Possible 10										Possible 30				Possible 60		Possible 90				Poss. 180																
Figures		Nons. Syl.		Unr. Words		Rel. Words		Rel. Sent.		Cont. Prose		Unr. Mat.		Rel. Mat.		All Mat.		All Three Experiments				Poss. 180														
1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	1 Pr.	2 Pr.	Fig.	U. W.	R. W.	R. S.		C. P.	U. M.	R. M.	M										
6.7	8.4	6.4	3.9	4.9	4.3	5.4	6.4	4.4	7.6	8.6	7.6	3.9	6.2	4.7	4.9	7.3	6.9	15.2	16.4	22	19.3	32.5	41.8	34.4	21.5	13.2	16.3	23.8	14.8	19.1	151	57.7	103.8			
A	6.5	7.2	5.2	3.2	4.5	2.3	5.4	6.4	2.7	7.2	7.8	6.2	3.6	5.3	4.5	4.6	7	6.4	15.1	18.1	10.3	15.3	20	16.9	30.4	38	27.2	19	10	14.5	21.3	3.7	8.4	43.4	52.3	95.7
BC	6.1	7.3	5.8	2.8	4	2.7	5.5	6.6	4.6	7	8.7	7.8	3.7	5.3	5.1	5.1	7.5	7.2	14.4	18	13.2	15.3	21.4	20.2	30.3	39.4	33.3	19.3	9	6.16	7.23	5.14	19.8	45.6	67.4	103
D	6.4	7.6	5.8	3.3	4.5	3	5.4	6.5	3.9	7.3	8.3	7.1	3.7	5.5	4.8	4.9	7.2	6.8	15.2	18.6	12.7	15.8	21.1	18.7	31	39.8	31.4	19.9	10	9.15	8.22	7.14	18.9	46.5	55.7	102.14
All	10	10	7	8.5	8.2	8.5	10	10	10	10	10	10	7	9	10	7.4	10	24.5	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9
Max.	1	3	0	1	2	0	2.2	3	0	4.2	3.5	1	1	2.5	2	1.9	3.2	1.9	5.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Min.																																				

GENERALIZATIONS

1. When series of ten figures, nonsense syllables, unrelated words, related words, related sentences, and a piece of continuous prose containing ten statements, are spoken, one series at a time, to a class of normal students (young women), only a little over half of the whole material (53.5% in 1915, 51.7% in 1916) can be at once written down by them as given.

2. If this material be presented again, several (from two to five) days later, from a seventh to a sixth of the material additional can now be written, or nearly seven-tenths in all.

3. After a few days interval, nearly as much can be recalled (47% in 1915, 52.4% in 1916) actively without any further presentation of the material (except, where necessary, the first member, as indicated above), as could be written immediately after the first presentation, showing how effective a second presentation is, and suggesting the importance of repetition and review in preventing the disappearance of what has once been in the mind.

4. Every experience leaves behind a disposition or latent tendency to recur to consciousness. Dispositions gradually weaken, fade or relax if not aroused, but repetition and reproduction stamp them more strongly upon the mind. Such dispositions vary greatly in strength with different individuals, being even twice or three times as strong in some individuals as in others of the same class of students. For example, in 1915 one student, at the first presentation of the six kinds of material, reproduced 73.7%, another only 37.5%. Upon the matter being presented again, one reproduced 91.7%, another but 40.4%, while, after an interval of several days, one was able to recall 77.9%, another only 22.4%. Of one or more of the six classes of material some students at the first presentation reproduce from 70% to 100%, while others reproduce only from nothing at all to 30%. Some dispositions may be compared to the eager sprinter tensely awaiting the signal to start, while others stand limp and listless.

5. Two classes of normal students of different years scarcely differ as wholes in the kind of mentality tested by this experiment. The average total number of points out of 180 taken by each member of the class of 1915 was 102.3, and by the class of 1916,

102.14. Different sections, numbering nearly thirty students each, of the same class, or of different classes, differ very little in memory in the aggregate, great as are the individual differences. A group of thirty persons is therefore large enough to furnish reliable generalizations on the memory. There are comparatively few extremes in any group: most individuals are of approximately average ability.

6. The consciousness of the first member of a chain of dispositions tends to bring the other members into consciousness in the order of acquisition or experience. But there is more in our minds than we can bring to consciousness at will. Examinations are therefore inadequate tests of culture. What we "have forgotten" may be more influential and formative than the matter that readily comes to consciousness.

7. In most people related material is more easily acquired, better retained and much more readily recalled than unrelated. The closer and richer the logical relation, that is, the more meaning the material has, the easier is the work of grasping and reproducing material. Ten related sentences containing 69 words are almost as easily acquired, retained and reproduced as ten related words. This is doubtless because the former embody more complete and hence more interesting cognition than the latter; they find something in the mind to which to attach themselves; sentences are in fact complete statements of thought or judgment, while single words are but vague concepts. This generalization, besides other suggestive value, has a direct bearing upon the teaching of reading. The sentence-method is evidently psychologically sounder than even the word-method, not to speak of the old letter-method.

8. A series of ten figures are more easily acquired in their sequence than a like number of nonsense syllables or even words. This is doubtless due to the circumscribed range of choice in the case of figures, together with the familiarity of each of the figures as compared with the nonsense syllables. The mind also readily arranges rhythmically familiar sounds like figures, and rhythm aids the memory.

9. It would seem also that with figures the element of chance would enter in as a factor in their arrangement in an especial manner, since there are only ten figures and the material is thus already known. To test this, I had the students write down what they guessed to be the arrangement of ten figures that I

had written out. It came out that on an average one of the ten figures was placed correctly by each pupil, or to be exact, .99 of a figure. Moreover, the result for each section was nearly the same as that for the whole class, namely, an average of one figure each for section A, .87 for section BC, and 1.1 for section D.

The pupils expressed great surprise at this result, which struck them as almost uncanny, and they felt sure it could not occur again, but that next time no one would get any right, as many said, or there would be greater discrepancy. So at their urgent request I made the experiment again with a new series unknown of course to them. I assured them it would come out much the same, and it so proved, for this time the results were, for the class .76 of a figure per pupil; for A .82, for BC .68, and for D .79. In both experiments the maximum number of figures rightly placed by any pupil was 4 and the minimum 0. While there was considerable discrepancy as to the number in the two experiments scoring 0 and 1, the same number obtained 2 in both instances, namely 15, and the number placing 3 and 4 right respectively, was 1 and 2 in the first experiment, and 2 and 1 in the second!

Such a result, even as the similar results with the memory, showing different groups and different years averaging about the same in various qualities and even in chance action, cannot but impress one with the similarity of human minds. And one is led to think of the facts of history and experience that bring the same testimony to the oneness of human behavior. I would remind the reader of the universally mythopeic character of human thought before the advent of Greek science and philosophy with the great original genius, Thales, and of the prevalence of practically the same myths and legends in widely separated portions of the globe. The same is true of fairy stories, animal tales and mother goose rhymes. The evolution of both oral and written speech affords the most striking and fascinating illustrations of this principle. In our own scientific and inventive age the law is seen to operate with quite as remarkable a precision. Witness the many instances of the same invention or the same scientific discovery (*e. g.*, a new planet), or generalization (*e. g.*, Natural Selection by Darwin and Wallace, Mendel's Law of Mutations by Mendel and De Vries), being made by different minds independently. And the spirit of the age—

what is that but the common element in human minds at the stage of evolution reached?

10. Nonsense syllables are much more easily reproduced after a long interval than figures. This is doubtless due to the monotony of the figures, and the curious and striking sounds of the nonsense syllables, which, besides making a deeper impression (*i. e.*, leaving behind a stronger disposition), also tend to set up associations as clues. The possible arrangements are equally great in both cases, consequently only the order counts. The general helplessness regarding the recollection of dates and other numerical facts is a corroborating illustration of this difficulty. Figures are words singularly devoid of concrete content. The weakness of the memory for words lacking in concrete meaning is a fact of especial significance for the teacher of little children, whose interest in the abstract is so slight.

Nonsense syllables are less easily acquired than words for immediate reproduction. This is explained by the greater familiarity of the words, and especially the difficulty of forming a visual image of the nonsense syllables. Though the immediate grasp of attention was much greater for unrelated words than for nonsense syllables, the attention for unrelated words was scarcely more effective for delayed recall, and the memory (as measured by a method to be explained later) was even poorer for unrelated words than for nonsense syllables. The unrelated ideas expressed by the words were evidently harder to remember than a succession of meaningless sounds. Perhaps this is because in the case of the words the attention is divided between the sound and the meaning (withal a very uninteresting meaning), while in the case of the nonsense syllables the attention is concentrated upon the sound. Neither of the two types of mind is much appealed to by a series of unrelated words, while the mind that I shall call, for want of a better adjective, image-forming, finds an interest in the new and striking sounds of the nonsense syllables. There is a tendency also to rhythmize a succession of meaningless sounds.

11. There is little difference between the capacity to acquire related and unrelated material for immediate reproduction, the weaker dispositions left behind by the unrelated material being yet strong enough for immediate reproduction. The impression does not need to be so deep, *i. e.*, the disposition does not need to be so strong or tense, as for delayed reproduction. That is why

the immediate and delayed reproduction of figures differ so markedly. This proves the futility, for culture, of cramming for examinations. The mass of dispositions thus hastily implanted being so weak, there is little chance for their apperception or organization with the logical system already in the mind, for which time and reflection are necessary. Thus little that is permanent is accomplished. Or, putting it in another way, matter can be learned mechanically well enough for examination purposes, which proves the unreliability of the results of set examinations. The proper way to test by examinations, therefore, is to give them when they are not expected, and upon material that has not been recently presented. Just after a vacation, for example, is better than just before.

12. Unrelated words are more easily reproduced after a long interval than figures, doubtless because of the meaning attached to the words as contrasted with the utter emptiness and monotony of the figures.

13. Seven is the maximum number of figures the average normal school student can grasp in one act of attention, and the longest series that she can grasp complete. This fact came out in an experiment with eighty students in 1914, who were given seven series of from four to ten digits orally.

14. One may have a poor "mechanical memory" and a relatively good "logical memory," and vice versa. For example, one student made 14.6 per cent. more points with the unrelated material than with the related, and another 35 per cent. more with the related than with the unrelated. Only 16 of the 82 students in 1915 made a better record with the unrelated than with the related material. Of these 16, six stood above the average in general standing and ten below. The only pupil of exceptional ability as measured by school standing who did worse with the related than the unrelated material has told me that she was unwell and nervous and over-anxious during the time of the experiments.

15. In endeavoring myself to reproduce long series of figures, I found that, if I attended to the matter with confidence and determination, I could succeed in recording figures correctly of which I had but the faintest shadow of an image, so faint that I was surprised when I found them correct. Several of the pupils said they had had the same experience. Energy of concentration and will is undoubtedly a factor in successful

mental work. It is, therefore, of importance to be in good physical condition when undergoing examinations.

INDUCTIONS FROM CORRELATIONS

I now proceeded to a closer analysis of the data with a view to determining more accurately the mental factors involved.

One sees that the result of the first presentation is a measure of the grasp of attention for immediate recall, or one may call it *prompt grasp of attention*, or *instant attention* for short. It has sometimes been called "*acquisition*." Retentiveness proper was here hardly involved, the time being so short, neither was reproduction, the material having never left consciousness; so that the record thus immediately taken after the first presentation is as good a measure as can be obtained of the grasp of attention. By attention we must here understand not the energy, for the pupils cannot have differed greatly in the amount of effort put forth, but the *scope of the mental imagery* in the case of meaningless material and the greater power of ideation of logical grasp, of perception of meaning and relations, in a word of *understanding*, in the case of the more meaningful material.

Similarly the *quantum* actively recalled on the last day of the experiment may justly be viewed as a measure of the *effective grasp of attention*, only those experiences being recalled that had left behind stronger dispositions. This factor is generally referred to as *delayed recall* or *reproduction*.

But what are we to use as a measure of retentiveness?

May the measure of *retentiveness* not be found in the percentage that delayed recall is of the highest record immediately after the presentation, whether the first or the second? For example, if in nonsense syllables a pupil scored 3, 7 and 2 respectively for first presentation, second presentation and delayed recall, her instant attention for this material would be 30 per cent., her second act of attention 70 per cent., her effective attention or reproduction or delayed recall (resulting from two acts of attention) 20 per cent., and her retentiveness $28\frac{4}{7}$ per cent. The records from the first and second experiments showed what they had grasped. Manifestly what they reproduced later after a considerable interval must be compared with the better of these and not with the number of units presented (which was always ten); for they could not be expected to recall what had never been strongly enough in their memory to be set down

just after they had heard it. But they may be fairly judged as to retentiveness by the persistence for several days of the materials they have not only heard but written down and thus also seen and no doubt inwardly pronounced while writing them.

Taking the 1916 class, I found that in 18.6 per cent. of the cases for all six materials the percentage so obtained was above 100, and in a quarter of these cases even from 20 to 100 above 100. While there might have been some irregularity, I know that this could not have been an important factor. The results suggest that a certain amount of mental activity went on more or less subconsciously and unintentionally, making it possible in some cases to reproduce better after a long interval than after a short. The correlations show, however, that it made very little difference whether I regarded 100 per cent. as the maximum, reducing to that figure all above it, or made 120 the maximum. In figures, nonsense syllables, unrelated words, related words, related sentences, and continuous prose the number of cases above 100 per cent. was 9, 14, 11, 16, 18, and 26, respectively.

Correlations showing Relations between Different Mental Qualities

	1915	1916	Average
1. 1 Pr. N. S. & 2 Pr. N. S. =	+.47	+.58	+.53
2. 1 Pr. N. S. & Rep. N. S. =	+.53	+.34	+.44
3. 2 Pr. N. S. & Rep. N. S. =	+.28	+.34	+.31
*4. 1 Pr. N. S. & Ret. N. S. = {	+.14 (max. 120)	+.48	+.31
		+.44 (max. 100)	
5. 2 Pr. N. S. & Ret. N. S. = {	-.36 (max. 120)	-.22	-.29
		-.18 (max. 100)	
6. Rep. N. S. & Ret. N. S. = {	+.73 (max. 120)	+.76	+.75
		+.76 (max. 100)	
7. 1 Pr. C. P. & 2 Pr. C. P. =	+.72	+.42	+.57
8. 1 Pr. C. P. & Rep. C. P. =	+.65	+.44	+.55
9. 2 Pr. C. P. & Rep. C. P. =	+.88	+.75	+.82
*10. 1 Pr. C. P. & Ret. C. P. = {	+.21 (max. 120)	+.19	+.20
		+.19 (max. 100)	
11. 2 Pr. C. P. & Ret. C. P. = {	+.21 (max. 120)	+.03	+.12
		+.15 (max. 100)	
12. Rep. C. P. & Ret. C. P. = {	+.65 (max. 120)	+.61	+.63
		+.68	
13. Rep. C. P. & Ret. N. S. =	+.11	+.30	+.21
14. 1 Pr. N. S. & 1 Pr. C. P. =	+.11	+.03	+.07
15. 2 Pr. N. S. & 2 Pr. C. P. =	+.04	+.04	+.04
16. Rep. N. S. & Rep. C. P. =	+.23	+.23	+.23
17. Ret. N. S. & Ret. C. P. = {	+.25 (max. 120)	+.17	+.21
		+.26 (max. 100)	

* For 1917, 1 Pr. N. S. and Ret. N. S. = +.24, and 1 Pr. C. P. and Ret. C. P. = +.09.

It is evident that the activity of subconscious cerebration was proportionate to the meaningfulness of the material.¹

After working out numerous correlations with the assistance of my pupils with all the data (having constantly eleven classes in each curve of distribution), I found that the nonsense syllables were the most typical unrelated material and the continuous prose the most typical related material. Without, at present, therefore, dealing with the other sorts of material, I shall confine myself to these two typical classes.

Examining, then, the correlations between *1 Pr.* (instant attention, immediate recall or acquisition), *Rep.* (effective attention, delayed recall or reproduction) and *Ret.* (retentiveness) for nonsense syllables and continuous prose respectively, we find a strong direct correlation between the first two powers for both unrelated and related material, a very strong direct correlation between the second and the third, and a not very considerable but still direct correlation between the first and third powers (Correlations Nos. 2. 4. 6. 8. 10, 12).

What does this mean? In the first place the popular judgment "Easy come, easy go" is proved to be erroneous as a general statement.

In the second place, if we are to regard these powers as factors of the "memory," the memory is evidently a very unitary thing and each factor is to a very considerable extent a measure of the others. This being so, examinations, which are primarily a test of reproductive power (delayed recall), are at the same time a pretty fair index of the powers of acquisition and retention also, and thus useful for the purpose of ranking pupils objectively.

In the third place there must be a strong common element underlying the three factors or powers in question. A careful reading of the correlations should reveal this.

The fact that the first act of attention, that is to say, readiness of grasp or acquisition of unrelated material, has a considerable direct correlation with both delayed recall and retentiveness

¹ I have just (January, 1917) conducted this experiment for the third time, and, so far as I have worked out the results, they confirm those stated in this article. For retentiveness, however, I have this time taken the percentage that reproduction is of the combined presentations, i. e., of the better of the records plus any *additional* material present in the other presentation-record. Naturally, the number whose retentiveness comes to more than 100 per cent. is now fewer. In R. W. there were two: 106 and 131; in R. S. four: 102, 104, 112, 114; in C. P. six: 102, 103, 105, 105, 115, 140. There were none for the other materials. This gives a juster idea of the matter. It should be added, however, that occasionally material that had not appeared in the records of the two presentations appeared in the delayed recall.

(Nos. 2 and 4), while the second act of attention has a slighter correlation with both, even, indeed, an inverse correlation with retentiveness (3 and 5), is another indication that the old adage "easy come, easy go" must be given up as far as unrelated material is concerned. In the case of related material, however, while the correlations of the two acts of attention with retentiveness were about equal (10 and 11), slow acquisition proved to be more effective than quick for delayed recall (8 and 9), time being more effective for the formation of clear ideas than of images, the latter depending more upon a peculiar native capacity than upon energy of effort.

There is further proof of this proposition. Attention (both first and second act) and delayed recall are more strongly correlated in the case of related material than in the case of unrelated (2, 3, 8, 9), while retentiveness and delayed recall are more strongly correlated in the case of unrelated material than in the case of related (6 and 12). Indeed, there is a very much stronger direct correlation between delayed recall and retentiveness for unrelated material than between instant attention and retentiveness, and there is even, as we have seen, an inverse correlation between the second act of attention and retentiveness, showing that the efficiency of the attention is not due to the effort of attention but to the retentiveness of the mind (4, 5 and 6). Where a second act of attention is necessary to the acquisition of unrelated material, retentiveness for such material is weak. A person who can retain unrelated material, therefore, is little dependent upon the amount of attention.

The capacity to recall related material evidently depends more upon that energy or repetition or application that results in clearness of the original impression, while that of reproducing unrelated material depends more upon native retentiveness for imagery experienced. It would seem, therefore, that no great retentive power is necessary for efficiency in the realm of thought, while the reverse is the case with the realm of mechanical association and meaningless sense-imagery.

One pupil will do as well after one act of attention to unrelated material as another will do after two acts of attention, or even better, owing to the superior retentiveness of the former (Corr. 2 and 3). This pupil has no more vivid sensations than another, but in her the images stick in the mind, while in the other they rapidly fade out unless repeated again and again. Mechanical

or sensory retentiveness, therefore, accounts for the power of instant attention to unrelated material as well as for the power of effective attention. Here, then, is the common element we sought, at least as far as unrelated material is concerned, namely *the native mechanical retentive power of the mind*. This is the prime factor of the memory. This is *the memory*. The other powers that aid us to remember are not memory at all. We shall see that they are mainly attention, mental imagery and understanding.

For the mastery of mechanical (*i. e.*, unrelated and comparatively meaningless) material, of which nonsense syllables are a type, retentiveness, which is a native gift, is more important than the effort of attention or concentration. To make up in part, however, for the lack of good retentive power one must apply oneself with repeated acts of attention. This shows the need of constant repetition and drill in school-work of a mechanical nature—if, indeed, work of such a nature should ever be required, and doubt is cast on this by the investigations of Kirkpatrick and Springer—and shows the injustice of accusing a child of inattention or indifference when he does not do well in such work. His failure may be due to his lack of native retentive power. Once pupils have really grasped an *idea*, however, we need not worry about their remembering it, whether they have good “memories” or not, for *the correlation between reproduction (delayed recall) and the second act of attention is exceedingly large (No. 9) while that between retentiveness and the second act of attention is exceedingly small (No. 11)*. For *meaningful* material the *understanding* or the power of perceiving logical relations is essential, and when this quality is weak, it must be aided by repeated attention to the relations, that is, to the meaning (stimulated by the art of the teacher), just as weak retentiveness in the case of *unrelated* material must be aided by repeated attention to the imagery. Retentiveness and the power of grasping logical relations do not necessarily exist together in the same measure; but weakness in retentiveness may be more than compensated by ready ability to perceive relations, or even by diligent application where one’s power of grasping logical relations is slow.

Thus we have found that *for efficiency in the mastery of unrelated and related materials respectively, one requires two quite different mental qualities, namely, retentiveness and understanding*.

Now by considering correlations 14 and 15 one will discover that *these two mental qualities are quite distinct and have nothing in common*, for there is practically no correlation between the attention for the two kinds of material, related and unrelated, whether the first or the second act of attention be taken. Excellence in one function does not imply excellence in the other, nor does it imply deficiency in the other.

Having established the independent existence of these two mental qualities, mechanical retentiveness and logical apprehension, it occurred to me that it would be interesting to correlate them with the pupils' general standing. The Junior subjects in the first year of the experiment (1915) were the ten following: English, Geography, History of Education, Psychology, Arithmetic, Natural Science, Drawing, Music, Gymnastics and Methods. The subjects taken by the Juniors of the second year of the experiment (1916) were English, Geography, Psychology, Arithmetic, Biological Science, Music, Gymnastics and Methods, or eight in all. I have made correlations with each of the subjects, but the material is so extensive that I shall reserve most of it for a future article, giving only the correlations with the subjects of each year taken together, called "General Standing," and with my own subjects of History of Education and Psychology in 1915 and Psychology only in 1916. I might mention here that for the two first terms of the year 1915 the correlation between my two subjects combined and general standing was $+.675$, and for the third term $.51$, and between psychology and general standing in 1916 for the first terms combined $+.61$, and for the third term $+.71$.

By consulting the correlations the reader may verify the following conclusions. *There is no relation between power of sense-imaging and general standing*, that is to say, general ability as tested by school teachers; for there is practically no correlation between attention to unrelated material (whether the first or the second act of attention) and general standing in the normal school subjects. (18, 19, 20.)

There is, on the contrary, a relation between ability to perceive logical relations and general ability, for there is a considerable correlation between both the first and the second act of attention to related material and general standing in the normal school subjects. (22, 23, 24.) As the correlation is somewhat stronger in the case of the second act of attention, it would seem that it

Correlations between Mental Qualities and School Standing

		1915			1916				
		1st & 2d Terms Com- bined	3d Term	Av. for Year	1st Term	2d Term	1st & 2d Terms Com- bined	3d Term	Av. for Year
18.	1 Pr. N. S. & General Standing	+.01	-.03	-.01	+.03	+.07	+.04		+.03
19.	2 Pr. N. S. & General Standing	+.01	-.09	-.04			+.07		+.04
20.	Rep. N. S. & General Standing	-.09	-.03	-.06			+.11	+.10	+.11
21.	Ret. N. S. (max. 120) & Gen. St.	-.09	+.02	-.04			+.09	+.16	+.13
22.	1 Pr. C. P. & General Standing	+.26	+.28	+.27			+.22	+.27	+.25
23.	2 Pr. C. P. & General Standing	+.29	+.36	+.33	+.32	+.28	+.34	+.38	+.33
24.	Rep. C. P. & General Standing	+.24	+.27	+.26			+.41	+.41	+.41
25.	Ret. C. P. & General Standing		+.03	+.02			+.24	+.18	+.21
26.	1 Pr. N. S. & Hist. Ed. & Psychol.		+.15						
27.	1 Pr. N. S. & Psychology		+.15		+.09	+.05	+.09	+.08	+.07
27b.	2 Pr. N. S. & Psychology							-.09	
27c.	Rep. N. S. & Psychology.							+.04	
27d.	Ret. N. S. & Psychology							+.18	
28.	1 Pr. C. P. & Hist. Ed. & Psych.		+.31						
29.	2 Pr. C. P. & Hist. Ed. & Psych.		+.32						
30.	Rep. C. P. & Hist. Ed. & Psych.		+.26						
31a.	1 Pr. C. P. & Psychology							+.30	
31b.	2 Pr. C. P. & Psychology		+.23		+.23	+.34	+.34	+.39	+.32
31c.	Rep. C. P. & Psychology.							+.47	
31d.	Ret. C. P. & Psychology.							+.23	
32.	N. S. (all 3 expts.) & Gen. St.	-.03	-.06	-.05					
33.	N. S. (all 3 expts.) & my 2 subjs.	+.03	+.02	+.03					
34.	C. P. (all 3 expts.) & Gen. St.	+.35	+.39	+.37					
35.	C. P. (all 3 expts.) & my 2 subs.	+.30	+.32	+.31					
36.	Mach. Mem. & General Stand.	-.02	-.04	-.03					
37.	Mech. Mem. & my 2 subjs.	-.07	-.10	-.09					
38.	Log. Mem. & Gen. Stand.	+.28	+.30	+.29					
39.	Log. Mem. & my 2 subjs.	+.25	+.27	+.26					

is at least no great disadvantage to be a little slow in grasping such relations, so long as one is "slow but sure." In this important matter, happily, diligence quite makes up for slowness. (22, 23.)

Mere retentiveness would seem to be very slightly and doubtfully related to general ability. (See Nos. 21 and 25 especially.) The presence of good retentive ability does not ensure good standing, neither does its absence condemn one to poor standing. Nor can one say that its presence is a hindrance, or its absence a guarantee of higher ability. *It is simply of no significance or importance.* This is indicated not only by the correlations of nonsense syllables and continuous prose with general standing respectively, but also by those of all the different classes of unrelated material (N. S., Fig. and Unr. W.) in all the experiments combined together in a single curve under the head of "mechanical memory" and all the results from the logically related materials combined under the name "logical memory" in the same way and each curve correlated with that for general standing (Correlations 36 and 38). The same is true when all three experiments in nonsense syllables are combined and correlated with general standing, and so also with the full data for continuous prose. (32 and 34.) By examining the correlations with my subjects substantially the same results will appear. The whole table of correlations, indeed, like the statistical table given earlier, is a beautiful harmonious picture of the reign of law in mental phenomena. The similarities between the two classes of normal school students stand out in an especially striking manner. It is evidently not our retentive power that conditions our general ability, nor is it our power of sense-imaging, neither is it primarily the effort of attention that makes us efficient; but *the ability to grasp logical relations and to see meaning is a considerable factor therein.*

"Do you mean to say," I shall be asked, "that the retention of logical associations is mechanical like that of sensory associations?" That, I reply, is what a study of the correlations suggests. Note in particular correlations 21 and 25, which show almost the same correlation between retentiveness for *related* material and general standing as between retentiveness for *unrelated* material and general standing, the correlations being very slight on the whole for both kinds of material.

It may be objected that, if the retention of sensory and that of logical associations are both mechanical, the correlation be-

tween them should be perfect, namely, $+1$, and that all I have established is that there is a mechanical element in the retention of both, which, it may be added, is further borne out by correlations 12 and 13, which show a much larger correlation between the delayed recall of related material and the retention of *related* material than between the delayed recall of related material and the retention of *unrelated* material. But the answer to this is that, while the retentivenesses for unrelated and related material appear to be both mechanical, they are really two kinds of mechanical retentiveness, involving different brain areas, and consequently cannot be expected to show a perfect correlation.²

It may be urged that the existence of a logical element in the retention of related material is suggested by the correlation, positive though slight, that appears between the general standing of the class of 1916 and their retentiveness for related material ($+.24$ and $+.18$), even though no such relation appeared in 1915. But it should be observed that there was a direct correlation of $.09$ and $.16$ also between retentiveness for *unrelated* material and general standing in 1916, or only $.15$ and $.02$ less than for related material. This slight difference (which appears also in the correlations, with psychology) may only show that the retentiveness for logical associations, mechanical though it be, is of somewhat more importance for general standing than retentiveness for sensory associations, just as the retention of logical associations is more strongly correlated with the delayed recall of related material than is the retentiveness for sensory associations (12 and 13).³

The mere retention, then, of logical associations would appear to be a mechanical thing—*i. e.*, a retention of the words independent of the ideas they express. When the ideas are also present,

² Indeed, for 1917, by the better method described in my previous footnote, I have found a very slight correlation between Ret. N. S. and Ret. C. P. ($+.07$). Moreover, the correlation between the various classes of material is always small. For 1 Pr. in 1917 N. S. & C. P. = $+.25$; N. S. & Fig. = $+.11$; U. W. & R. W. = $+.31$; R. S. & C. P. = $+.22$. Evidently both the grasp of attention and the retentiveness for different classes of material vary greatly, which bears out the contention of those who say there is no memory but only memories. These correlations are all positive, however, so that there is evidently a common element or basis of general retentive capacity.

³ For 1917, however, I have just ascertained the correlation between Ret. C. P. and Psychology First Term to be $-.05$, and between Ret. N. S. and Psychology $+.14$. These slight variations from zero, therefore, have no significance. There is evidently no correlation between retentiveness of any kind and school standing. 1 Pr. with Psychology, on the contrary, for the first and second terms of 1916-17, gives $+.38$ and $+.28$ respectively, or substantially the same as in the previous year ($+.30$).

they are there not because of any excellence in the memory but by virtue of the clear original grasp of them as shown by the delayed recall or reproduction, which has constantly a substantial correlation with general standing and with psychology.

Why, then, I may be asked, does one often need to "brush up" for examinations? This is because, while the logical content has become an integral part of one's mental complex, the mechanical part, on the contrary, or the mere words in which the meaning is clothed, seeing that they depend not on understanding but on retentiveness, may fade away and thus make the meaning difficult to recall. Hence the necessity of brushing up for examinations, preferably by thinking over the subject and getting one's ideas upon it into some form, which is always a form of words. And the greater one's powers of linguistic expression, the more this brushing up can take the form of reflection, and the less one needs to reexperience the original (lecture, author, notes, etc.). This is a point of the utmost significance to the examiner, who ought to so frame his questions that they will test the student's understanding rather than his memory, if it is really the student's understanding of the subject that he desires to ascertain.

The correlations of 1915 seem to indicate that the ability to understand or apprehend related material at its second presentation is more valuable than the ability to reproduce such material later (Nos. 23 and 24), that what one understands has already entered into one's mental system, even though one may not be able to call it up out of this complex at will,—perhaps all the more on that account. But the correlations of 1916 do not bear out this conclusion. Further experiments are necessary. It is consistently suggested, however, that the ability to give forth related material immediately after its second presentation is a better index of mentality than the ability to give it forth immediately after the first presentation (Nos. 22 and 23). In the latter process the memory is likely to play a larger part than in the former. One who is dependent upon the perception of meaning and relations—the selecting and relating power of the mind—may require more opportunity for attending to these relations in order to reproduce the material than one who is more gifted with retentiveness. Other factors, of course, cooperate to make general ability. It must be remembered, also, that the fallible and changeable judgment of the teachers is a

factor in the standing assigned to a pupil. Of that I shall have more to say in a future article.

In conclusion I should like to say a word about the value of work of this nature to the normal students engaged in it. I have noticed a remarkable increase in accuracy in the working out of averages and correlations by the students. To see a whole class of young women, who have passed through not only the grades but the high school, differ among themselves and every one wrong in a matter that calls only for accuracy in copying figures and handling them according to the fundamental rules of arithmetic, makes one confess that there must be something in the criticisms of our schools that one sometimes hears from business men. At the same time the progress in accuracy that these same young women made in mathematically searching out the interesting truth hidden in the simple data of this experiment suggests the remedy.

The framing of generalizations based upon the results thus mathematically obtained from the experiment is a very valuable exercise; and such generalizations form a solid foundation for the intelligent discussion of other scientific articles and finally of actual schoolroom practice. One cannot dip into the human mind, however humbly and inadequately, without a fresh realization of its complexity and of the many factors that subtly enter into its composition. And no student can go through such an experience without feeling an increased respect for science, and in particular for that science upon which all thoughtful teaching must be based, if teaching is to become to these young students a profession and not—as some would have it—a mere mechanically acquired trade.

The results of the investigation plainly suggest the uselessness of efforts to "train the memory," that pedagogical fetic of the past. Even if one can improve it, it is not worth while doing so. The teacher should give all his attention to training the child's understanding and judgment, and his powers of linguistic expression. Once a child has been got to express an idea clearly in his own words, he is guaranteed against forgetting it. It is ever after a part of his mental equipment. What the teacher should constantly aim at, therefore, is to present culture material of such a nature and in such a way that it may enter into vital, meaningful relation with the child's present mental complex.

Nothing should be taught in isolation, but everything in situation, in application, in logical connection as part of a whole. Only thus can it be really assimilated.

No thoughtful person can enter any of our grade schools without being struck by the futility of much of the work done. Many of the facts and details presented and drilled upon are destitute of all fruitful meaning to the pupils, who later, with maturer intelligence and interest, could acquire, in a short period of study, much more than they are thus forced prematurely to learn during years of effort altogether out of proportion to the value of the matter presented. In fact, once the child has learned to read, his geography, history and literature should be mainly a course in reading, supplemented by occasional discussion within the scope of his interests and capacities, in which the teacher should try to lead him onward while never getting away from him.

PRACTICE AND TRANSFERENCE IN NORMAL AND FEEBLE-MINDED CHILDREN¹

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PART I. PRACTICE

The work here reported was carried on to determine how feeble-minded children compare with normal children of the same mental age as regards practice effects and the transference of training. The problem is a large one, as no conclusions are valid unless they are true for the vast feeble-minded population as a whole. It is not to be expected that one investigation, conducted with small groups of children and with one particular set of tests, will lead to a final solution. It is reasonable to suppose, however, in view of the importance of the problem for the understanding of education and of the nature of intelligence, that the present work will be extended by others who will test and modify the conclusions here reached.

The plan of work adopted required four groups of children. These groups were a normal practice and a normal control group, and a feeble-minded practice and a feeble-minded control group. The children of each group were selected so as to give about the same average mental age, namely, nine years.

The mental age of the feeble-minded children, inmates of the State School for Feeble-Minded at Faribault, Minnesota, was determined by means of Kuhlmann's revision² of the Binet tests. Children who had not been tested recently were retested. All were tested by Dr. Kuhlmann himself, and the ages used are the ones furnished by him. The average chronological age of both the feeble-minded groups was slightly under fourteen.

In the case of the normal children, the chronological age alone has been used. It is reasonable to suppose that with these children the difference between the average mental age of a group and the average chronological age would be slight. It would very likely be less than the difference between the average mental age as determined by the Binet tests and the average true mental age.

¹ The writer begs to acknowledge gratitude to Dr. A. C. Rogers, Superintendent, and to Dr. F. Kuhlmann, Director of Psychological Research of the Minnesota School for Feeble-Minded and Colony for Epileptics. Thanks are also due to Dr. F. E. Spaulding, Superintendent of the Minneapolis Public Schools.

² J. of Psycho-Asthenics, Monog. Sup., Vol. I, 1, pp. 41.

The composition of the various groups with respect to age is shown in Table I. The ages have been left in years and months. Thus, 9.3 means nine years and three months. Boys are distinguished by a star placed before their ages.

TABLE I
Composition of Groups with Respect to Chronological and Mental Age

Group	F. M. Practice		F. M. Control		Normal Practice		Normal Control	
No.	Chron.	Mental	Chron.	Mental	Chron.	Grade	Chron.	Grade
1	15.0	9.3	*15.2	9.4	*9.8	3A	8.10	3B
2	*12.6	9.4	*10.5	9.4	*9.6	3A	*9.0	3A
3	15.3	9.8	*13.8	9.2	8.7	3B	*8.11	3B
4	19.3	10.0	20.7	8.8	8.1	3A	9.2	3A
5	12.5	9.0	12.4	8.2	8.2	3B	*9.1	3A
6	17.0	9.2	*12.1	9.0	8.8	3A	9.2	3A
7	12.8	8.4	18.11	8.6	9.11	3A	8.6	3A
8	*12.0	8.0	14.1	9.0	*9.3	3A	*9.1	3A
9	*13.1	8.2	10.3	8.2	9.2	3A	*9.1	3A
10	15.0	8.10	15.2	9.6	9.5	3A	8.11	3A
11	13.1	8.2	20.4	8.8	*9.3	3A	9.0	3A
12	16.6	9.0	*12.8	8.2	9.2	3A		
13	*11.6	8.0	*10.11	8.0	9.7	3B		
14	*11.6	9.6	*11.3	9.0	*9.0	3B		
15	*12.2	8.0	*11.3	8.2	*8.11	3A		
16	12.9	10.4	11.6	9.0	9.2	3B		
17	10.1	7.11	15.6	8.4				
18	13.3	9.2						
19	14.8	8.0						
20	*14.5	8.6						
Av.	13.8	8.10	13.10	8.9	9.1		9.0	
M. V.	1.9	.8	2.8	.5	.5		.2	

The groups were selected so as to secure equality, not only in mental age, but also in initial ability. The feeble-minded children were selected by going through the files of the state institution and writing down the name of every inmate, under twenty chronologically, recorded as mentally eight or eight and a fraction. A few somewhat under eight were also listed, when there was reason to believe that they had improved since their last testing, which in some cases was several years back. This procedure gave a list of over one hundred children. This list was taken to one of the officers of the institution who scratched off the names of the children who for one reason or another were not available. Some had epilepsy, some were working on the farm, some had gone home, some were sick, some lived in a cottage too far away for the attendant to go after them, etc. The list of available children was thus reduced to fifty.

Work was begun with all these children, in two sections, work with one of the sections beginning a week later than with the other. At the end of the initial tests, both sections were divided into two groups of equal average initial ability, one group becoming thereupon the practice group and the other, the control group. For the final tests the groups came together again in two sections as at first. While the work at the state institution was being carried on, children were constantly leaving for home, for vacation, so that, while at the beginning of the work there was a practice group of 28 and a control group of 22, at the end, the practice group numbered only 23 and the control group 19.

In order to equalize the feeble-minded groups with each other in initial ability in the end tests and with the normal groups in initial ability in both the practice tests and end tests, it was necessary to reject the results of several children. The number rejected was the smallest that would render all four groups about equal in initial ability. Three were rejected from the feeble-minded practice group and two from the feeble-minded control group, thus leaving 20 in the former and 17 in the latter. The records that were rejected were above the average and were made in all cases but one by children whose mental age, at the last testing, was ten or over. The rejecting of these cases rendered the average age of the feeble-minded groups a few months less than that of the normal groups, but it was thought better to have equal initial ability than exact equality of mental ages.

The normal groups were selected, each from a different Minneapolis school, by going to the principal and asking for a group of children who were of normal grade for their age and who would average nine years chronologically. The normal practice group originally numbered nineteen, but as two children missed several periods on account of sickness, and one girl was dismissed after a few days because of chorea, the group became reduced to sixteen. In the case of the normal control group, in the Lowell school, the ranks were greatly depleted at the time of the final tests on account of a scarlet fever epidemic which broke out in the school. The original group of nineteen was reduced to thirteen. Two of these thirteen were rejected in order to get a group which matched the other three groups in initial ability.

The plan of work followed was the same for both the normal and feeble-minded groups. First, both the practice and control

groups were given the end tests, four in number. The four end tests were all given the same day, but given twice, so that two days were devoted to them at the beginning and also at the end of the work. They consisted of the following: sorting five lengths of sticks into five boxes of corresponding length; sorting colored pegs; a letter cancellation test; and a geometrical form cancellation test. After the initial giving of the end tests, the practice group was given thirteen days' practice (consecutive except for Saturdays and Sundays) in the practice test. The control group "rested" for the same period. At the end of these thirteen days, in the case of both groups, the end tests were given again.

Before taking up the results on transference, those on practice will be presented. After a detailed description of the practice test and the method of giving it, the data will be presented in full as tables and practice curves and then discussed with some reference to related work of previous investigators.

The practice work given to the practice groups was a geometrical form sorting test, consisting in sorting gun wads on which were pasted labels bearing the printed outlines of simple geometrical forms. There were five different kinds of these labels, and wads bearing the same kind of label had to be sorted into the same box. The outlines used were those of the Woodworth-Wells substitution test³ namely, star, circle, square, cross and triangle. Woodworth-Wells blanks, after being painted on the back with mucilage, were cut up until 10,000 small bits of paper were secured, each having printed on it a geometrical form. These printed forms were stuck onto gun wads, the same form being stuck on both sides of the wad. These gun wads were then divided into twenty sets of 250, each set containing 50 of each type. The set of 250 was placed in a paste-board box 6" square and 1.5" deep. Each wad had to be transferred from this box into a small box, bearing the same label. The small boxes, five in number, were 3" x 2" x 1.5". They were placed in a line at the edge of the child's desk furthest from his body, and the large box placed between the body and the line of small boxes. The order in which the small boxes was placed was changed every second day, as it was thought best to exclude practice effects due to becoming familiar with a certain order and to prevent the test from becoming too automatic.

³ Psychological Monog., Vol. XIII, 5, p. 53.

Preliminary practice trials with a few children showed that it would not require much more than 4 minutes to sort the entire 250 wads. As 4 minutes did not seem long enough for a day's practice, it was decided to give the test twice, allowing 4 minutes each time. On account of the labor of preparing the tests and the number of boxes required, only one set of tests was used. Consequently, immediately after the first sorting, the children were instructed to dump the wads again into the large box. The box was then covered, the wads shaken up and the sorting done over again. Only the results of the second sorting were counted, except on the first day. On this day, only one sorting was required, so that it would be possible to obtain the really initial ability of each child.

The instructions were to sort the wads as rapidly as possible, using only one hand and picking up only one wad at a time. No mention was made of accuracy. Each day the children were reminded that they should do their "level best" and that it was how many they got sorted that counted. With these instructions, which were solely and unambiguously for speed, the best way of scoring is to take merely the total number correctly sorted; and it is this number that is given in the tables and practice curves. The number of mistakes made was recorded, but was found so small that space will not be taken to present the data on this point for the separate individuals, but only for the groups. The number sorted was noted separately for each form. It was found that the total number sorted by each child at each testing was usually well distributed among the five different forms. Consequently, only the total number sorted will be reported.

Every effort was made to keep the conditions as uniform as possible throughout all the work with all the groups. That perfect uniformity was attained is, naturally, improbable. In both groups certain boys at times became more interested in each other than in the tests. This was particularly true of three boys in the normal group, and remained true even after their seats were changed. On the other hand, it is true, that, in a general way, the feeble-minded children were more disorderly than the normal ones. The disorderliness of the feeble-minded children, however, was kept in check. They came in and went out boisterously, and one hardly dared turn his back on them;

but, while the actual work was in progress, they seemed always to be trying to do their best. All the tests on both groups were given by the writer, who tried to maintain throughout a machine-like regularity in his directions. It is probably impossible, however, entirely to avoid variations in enthusiasm, which may affect the class. Other varying factors were the weather (the feeble-minded were tested in the summer vacation and the normals in the fall) and the work done by the children during the forenoon (both practice groups were tested in the afternoon).

The results are given in Tables II and III. In Table II, are given the scores made by each child on each day, and also the averages for the group. Immediately below each average, in the line headed, at the left, P. E., is given the probable error of a single measurement. In the line headed, at the left, Av. Er., is given the average number of wads wrongly sorted. It will be seen that this is usually much less than one per child, and therefore of negligible importance. The averages of Table II are plotted as practice curves in Figure 1. In Table III, are given for each child the initial ability, the final ability, the absolute improvement (I) and the percentage improvement (% I).

TABLE II

Data on Practice in Sorting Geometrical Forms, by Normal and Feeble-Minded Children of the Same Mental Age

*Order	1, 2, 3, 4, 5	5, 1, 2, 3, 4	5, 3, 2, 4, 1	4, 1, 3, 2, 5	1, 5, 2, 3, 4	4, 1, 5, 3, 2	3,1,2,4,5						
Trial	1	2	3	4	5	6	7	8	9	10	11	12	1g
F. M. 1	129	128	126	158	139	163	169	158	185	167	158	171	175
" 2	94	116	101	139	129	144	130	135	114	121	150	131	146
" 3	154	188	174	190	213	197	230	218	218	204	222	226	201
" 4	112	166	177	190	166	197	176	185	200	186	192	178	203
" 5	120	145	157	165	180	186	186	194	208	222	197	224	193
" 6	108	148	144	167	156	152	152	175	181	192	173	179	167
" 7	127	140	129	120	126	128	143	143	146	143	141	143	144
" 8	94	125	115	134	162	173	174	213	169	206	199	191	209
" 9	136	132	128	139	146	160	139	169	120	128	132	157	166
" 10	120	142	116	119	138	155	146	137	164	159	150	152	142
" 11	138	169	169	173	177	172	168	161	167	169	186	155	184
" 12	125	158	147	142	146	141	133	170	200	157	188	167	182
" 13	83	79	77	112	90	101	87	107	101	107	102	104	111
" 14	127	144	141	165	127	140	145	108	133	186	168	176	212
" 15	122	94	103	98	122	105	91	97	102	93	81	102	103
" 16	104	123	99	99	121	125	121	136	137	127	140	158	149
" 17	124	166	139	139	146	181	171	184	192	193	188	200	179
" 18	140	175	181	179	190	192	193	199	199	192	196	209	214
" 19	142	154	164	182	181	223	188	188	218	202	197	217	208
" 20	114	143	149	161	152	163	157	187	188	203	185	188	203
" Av.	121	142	137	149	152	160	155	163	167	168	167	171	175
" P. E.	12	17	19	19	19	20	23	23	25	26	23	23	22
" Av. Er.	1	1	0	1	2	0	1	1	0	1	1	1	0
Normal	147	148	151	152	191	166	182	176	191	173	182	187	197
" 2	144	156	156	150	176	172	152	166	157	144	143	165	176
" 3	130	149	140	144	164	198	195	200	199	180	177	192	191
" 4	119	135	127	160	157	177	156	151	182	173	165	149	166
" 5	114	137	142	150	148	168	162	148	149	161	156	163	197
" 6	118	136	127	154	158	170	153	170	151	166	147	173	159
" 7	107	125	131	139	149	143	149	140	148	153	163	169	173
" 8	125	143	146	128	149	184	154	166	162	197	178	173	163
" 9	100	112	95	107	119	116	131	120	115	133	125	129	132
" 10	122	150	158	166	160	175	172	198	198	182	191	224	213
" 11	113	153	141	143	141	160	165	172	155	150	172	172	186
" 12	104	117	87	132	126	146	147	169	152	151	157	157	163
" 13	99	76	119	106	119	124	124	107	112	135	135	142	144
" 14	121	131	99	119	137	130	109	153	150	141	156	152	156
" 15	155	145	154	182	168	183	193	189	149	167	180	187	204
" 16	129	166	179	192	188	200	191	181	200	200	184	222	199
" Av.	122	136	135	145	153	163	158	163	161	163	163	172	176
" P. E.	11	14	16	16	14	16	16	16	18	13	12	17	15
" Av. Er.	0	0	1	0	1	0	1	0	0	0	0	0	0

* In designating the order, numbers are used in place of the actual geometrical forms pasted on the fronts of the small boxes. Thus, the order, 1, 2, 3, 4, 5, means that the small boxes were arranged from left to right as follows: star, circle, square, cross, triangle. The order was changed every second day.

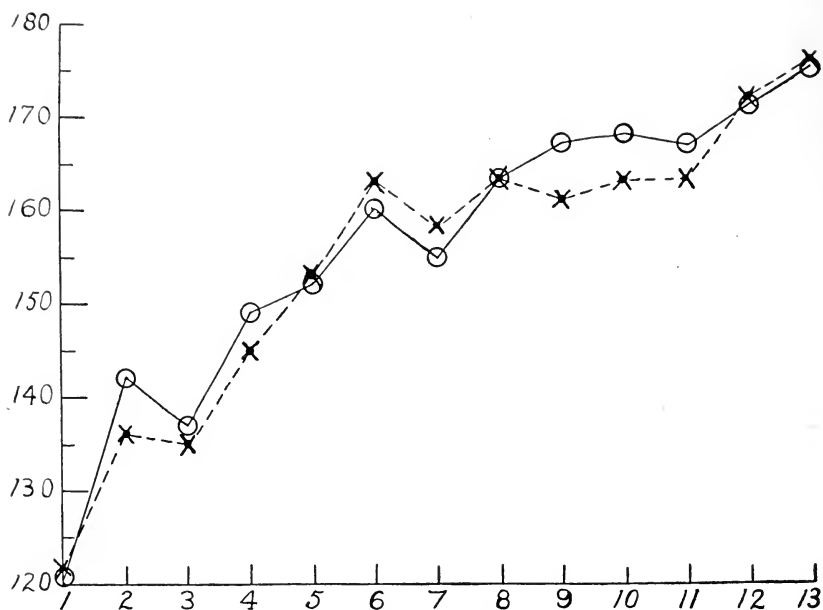


FIGURE 1.—Practice Curves. Ordinates represent the group averages, and abscissae, the number of days practice. The results obtained with the feeble-minded group are represented by circles, connected by continuous lines, and those with the normal group, by crosses, connected by dashes.

TABLE III

The Absolute and Percentage Improvement of Each Child of Both Normal and Feeble-Minded Groups

	Feeble-Minded				Normal			
Child	Initial	Final	I	% I	Initial	Final	I	% I
1	129	175	46	36	147	197	50	34
2	94	146	52	55	144	176	32	22
3	154	201	47	33	130	191	61	47
4	112	203	91	81	119	166	47	39
5	120	193	73	61	114	197	83	73
6	108	167	59	55	118	159	41	35
7	127	144	17	13	107	173	66	62
8	94	209	115	123	125	163	38	30
9	136	166	30	22	100	132	32	32
10	120	142	22	18	122	213	91	75
11	138	184	46	33	113	186	73	65
12	125	182	57	46	104	163	59	57
13	83	111	28	34	99	144	45	45
14	127	212	85	67	121	156	35	29
15	122	103	—19	—16	155	204	49	32
16	104	149	45	43	129	199	70	54
17	124	179	55	44				
18	140	214	74	53				
19	142	208	66	47				
20	114	203	89	78				
—	—	—	—	—	—	—	—	—
Av.	121	175	55	49	122	176	55	46

The question of main interest in connection with Tables II and III and Figure 1 is, whether the feeble-minded children show the same improvement with practice as do the normal children. This question, from whatever angle studied, must be answered in the affirmative. The equality of ability between the two groups (secured so far as initial ability is concerned by their manner of selection), remains fairly intact throughout the course of the practice, and is as definite at the end of the practice as at the beginning. For each group, the absolute improvement in average ability is 54, or about 45%. Upon computing the averages of the percentages of improvement shown by the individuals of each group (Table III), we obtain an average of 49 for the feeble-minded children and one of 46 for the normal children.

In both groups, the linear correlation between the initial abilities of the children and the percentages of improvement is negative, the correlation being $-.36$ (P. E., .13) for the feeble-minded group and $-.40$ (P. E., .14) for the normal group. If, instead of computing the correlation between initial ability and percentage of improvement, we compute that between initial ability and absolute improvement, we find in the case of both groups that the correlation remains negative but becomes very small (and unreliable), changing for the feeble-minded group from $-.36$ to $-.13$ (P. E., .15) and for the normal group from $-.40$ to $-.11$ (P. E., .17). On the average then, there was a tendency in both groups for the children who were below the average in initial ability to improve, relatively, more than, and absolutely, almost as much as, those who were above the average in initial ability.

So far we have spoken of amounts of improvement. It remains to be considered whether there is any difference in the regularity of the improvement of the individuals of the two groups,—whether the feeble-minded child shows greater fluctuation or irregularity in his practice curve than does the normal child. To determine this point, a table was constructed showing how much each child deviates each day from the general average of his group. The mean variations of these deviations were then calculated for each child. These mean variations serve as a fair measure of the regularity in the individual practice curves. The averages of the mean variations of the two groups may be used to compare the regularity in improvement of the normal children as compared with the feeble-minded. The average of the individual mean variations thus calculated was, for the normal group 9.0, P. E. *Av.*, 0.3, for the feeble-minded group, 10.7, P. E. *Av.*, 0.6. The difference is 1.7, P. E., .67. It is thus evident that the feeble-minded children showed somewhat greater irregularity in their improvement, but the difference being less than three times the probable error of the difference, is not great enough to have much significance.

To sum up, in the present experiment, feeble-minded children were found to show the same amount of improvement and to improve in accordance with essentially the same practice curve as normal children of the same mental age and the same initial ability. While in both the feeble-minded and normal groups

there existed great individual variation, it was impossible to discover any effects of practice which were significantly different for the two groups.

These results were obtained from one sort of work and on small groups of children. It is, therefore, interesting to inquire if there is any previous work that tends to indicate that the present results could not be generalized. So far as the writer can discover, there is not. Practice curves obtained on normal and feeble-minded children of the same mental age have not hitherto been published. Colvin has read a paper⁴ on practice and transference in normal and subnormal children but has not as yet published his data. Without the complete data, on an experiment of this sort, one cannot judge of the validity of any conclusions that might be drawn. Kuhlmann and others have published studies of practice in feeble-minded children, but they have not used normal children for comparison.

Kuhlmann takes for granted⁵ that the feeble-minded improve less with practice than normal children, but he does not say, expressly, less than normal children of the *same mental age*, or less than normal children of the same initial ability. Of course, we must remember that his study was made in 1904, before the origin of the Binet and Simon scale for measuring intelligence. The writer does not find anything in Kuhlmann's results that could not be duplicated in normal children. Slow progress or even retrogression is not necessarily a sign of an abnormal practice effect. The recent work of Ordahl and Ordahl,⁶ undertaken at the suggestion of Kuhlmann, shows practice curves from feeble-minded children that are as *normal* as could well be imagined.

Now it is true that we can get at the characteristics of the feeble-minded by comparing them with normal persons of the same chronological age. We thus come to the conclusion that they are characterized by inability to learn, by lack of attention, by incapacity for sustained voluntary effort, by lack of judgment and reason; but all these shortcomings characterize a six-year-old child compared with a ten-year-old child. Before we can conclude that the feeble-minded differ in any of these characteristics

⁴ *Proceedings of the American Psychological Association*, Psychol. Bull., 1915, Vol. XII, p. 67.

⁵ *Experimental Studies in Mental Deficiency*. Amer. J. of Psychol., 1904, Vol. XV, p. 413.

⁶ J. of Psycho-Asthenics, Monog. Sup., Vol. I, 2, p. 33 and elsewhere.

from normals of the same mental age, we must carefully compare them with normals of the same mental age.

Some prejudice against admitting that feeble-minded children improve with practice as much as normal children of the same mental age probably exists because of the tendency to identify capacity for mental development with ability to learn, with ability to gain by practice. The writer sees no reason for such an identification, but believes that the preceding data (which will be corroborated by results to be presented on the control groups) strongly suggest that it is not inability to learn which characterizes incapacity for mental development, but inability to grow, and that the two are quite distinguishable. The matter of the spread of training has, however, to be carefully considered. It may be that normal and feeble-minded children of equal mental age show the same improvement in the activity practiced, but unequal spreading of that improvement to related activities. The data obtained on this question will be presented in a subsequent paper.

AN INVESTIGATION INTO THE RATE OF MENTAL ASSOCIATION

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No apology is needed for a re-investigation of this problem. Association and associative memory form the basis of all intellectual life; the rate of association alone is of absolute importance to teachers in determining their rate of questioning; and definitely attested facts procured by experiment in association can never be too numerous.

The present investigation seeks mainly to determine the question of the rate of mental association. Ziehen in his pioneer work on *Association* suggested that the rate decreased with age. His subjects were so few in number that it is not surprising to find contradictory results shown in a later investigation by Rusk.¹ And although Meumann in the second edition of his *Vorlesungen* (Vol. I, p. 513) accepted Rusk's results, the latter was not satisfied that any scientific conclusion had been obtained, and after communication with Meumann, agreed that only a new investigation with a larger number of subjects of each age could give reliable averages and determine the question. The objections which Rusk foresaw, and of which he warned Meumann, have since been urged by Whipple.²

The present experiment has therefore been undertaken. Rusk's technique has been adopted, but on his recommendation certain improvements have been made, as follows:

(a) The number of subjects was increased; 15 8-year-olds, 26 10-year-olds, 22 12-year-olds, 18 14-year-olds, and 10 adults were taken. The majority were girls.

(b) The median of results (as before) was taken as the representative figure for each individual, but to secure greater reliability and to facilitate calculation the series was arranged to comprise 19 members. The 10th thus became the representative figure, and half the difference between the 5th and the 15th was regarded as the semi-interquartile variation.

(c) The series was limited for this experiment to uncontrolled concrete associations.

¹ *British Journal of Psychology*, Vol. III, part 4, p. 349.

² *Manual of Mental and Physical Tests*, 2d ed., Part II, p. 78.

(d) Only one form of instruction was employed. The imagery was not to be investigated, so the instruction was simply: "Give the first word." "As quickly as possible" and "Take your own time" were both omitted.

The median is to be preferred as the representative figure because it is more reliable than the average which allows abnormal results to interfere unduly with the representative value.

The series used consisted of the following words—*Gun, Water, Lamp, Piano, Watch, Butter, Purse, Barrel, Stamp, Market, Picture, Ink; Motor, Ribbon, Coal, Rain, Post, Mat, Horse, Table, Foot, Hat, Boot*. Only 19 of these were registered for each child: the order of presentation was constantly varied.

TABULATION OF RESULTS

TABLE I

Summary of the Results for the Time of Response of Each Age-Group

Age	Number Subjects	Average of Individual Medians	Fastest Individual Median	Slowest Individual Median	Average Semi-Quartile Deviation
8	15	2.6	1.6	5.0	.8
10	26	2.3	1.4	5.0	.7
12	22	1.7	1.0	3.0	.4
14	18	1.57	1.0	3.0	.6
Adult	10	1.5	1.0	2.2	.3

(There were 3 boys in the Age 8 group and 5 men in the adult group. All figures are in seconds.)

TABLE II

The Median Time of Response of Each Age-Group to Each Stimulus Word

Age	Gun	Water	Lamp	Piano	Watch	Butter	Purse	Stamp	Market	Picture	Ink
8	2.3	2.8	2.4	2.6	2.7	2.6	2.5	2.8	3.6	2.6	2
10	2	2.35	2	2	2.1	2	1.7	1.8	3.4	2	2
12	1.6	1.95	1.2	1.4	1.4	1.4	1.6	1.4	1.6	1.9	1.2
14	1.7	2	1.2	1.6	1.4	1.4	1.2	1.4	3.4	1.8	1.2

Age	Motor	Ribbon	Coal	Rain	Post	Mat	Horse	Table	Foot	Hat	Boot
8	2.8	2.2	2.2	4	3.6	2.2	2.7	2.3	2.9	2.4	2
10	2	1.6	*2	*2.6	2	3	3.2	2.5	*2.3	2	2
12	1.4	1.5	*1.4	*1.7	1.45	2	1.4	1.4	*1.8	1.4	1.5
14	1.5	1.6	*1.9	*2.4	1.4	2	2	1.5	*2.1	1.3	1.3

(Out of these 22 words, different sets of 19 only were presented in varying order to each subject.)

RATE OF RESPONSE

The average of the medians for each age is shown in the following figures.

Age 8.....	2.6 seconds
Age 10.....	2.3 "
Age 12.....	1.7 "
Age 14.....	1.57 "
Adults.....	1.5 "

This seems to point to a definite increase in speed of association from year to year up to the age of 14, and confirms Ziehen's suggestion.

It is notable that there is practically little difference between the results for Age 14 and for adults. The suggestion is made, however, that after 14 the rate of association may slow down again, on account of greater thought being given to the content of the word, and the existence of a wider range of associations from which to choose. It is possible, of course, that this tendency might not prevail against that of correlative and purely verbal association.

On the whole, as regards both rate and quality of association, the results obtained from adults by this method are likely to be less reliable than those obtained from children; the answers are less spontaneous, candid, and unreflecting.

QUALITY OF RESPONSE

1. In analysing the results from the standpoint of intelligence, the experimenter was led to attach much more importance to the varying types of answer than to the mere speed of reaction.

The subjects were drawn from free primary schools and from the primary and secondary departments of a higher-class school. Each group was graded according to intelligence on an estimate based partly on class-places, and partly on the teacher's verdict. No definite correlation could be established between this grading and that based on speed of association, more especially in regard to pupils from the higher-class school. In free-school pupils there was no correlation at all between speed of reaction and originality of response, but there was a certain correspondence between speed and the class-place assigned by the teacher. This looks as if rapid attainment of answering, at the expense of

thought, leading to a rigid and mechanical handling of class subjects, were characteristic of the free primary school in this particular instance.

The ease and quickness with which the nature of the experiment was grasped afforded a much more satisfactory test of intelligence. Speed in comprehension of a new idea—which is not the same as simple association might conceivably be an index of intelligence.

2. Despite the immense variety of individual responses, it is possible to group the answers into three main classes: (a) associations on the same plane of thought, such as *rain—hail*, *watch—time*, *ribbon—hair*; (b) associations denoting use or activity, as *piano—playing*, *purse—opens*, *ink—write*, *ribbon—tie*; (c) associations describing some quality of the thing given, as *butter—salt*, *gun—shiny*, *ribbon—blue*.

These three types of association are referred to as Relatives, Activities, and Qualities, respectively. Word completions have been classed as Relatives.

In the light of Stern's categories of observation, it is interesting to consider the percentages of each type for different ages.

i. At Age 8 we have a balance between Relatives and Activities. Only a few showed preponderance of Qualities, which in every case were colors. The actual percentages are: R, 43.2; A, 42.5; Q, 14.3.

ii. At Age 10 a mixed type emerges, a combination of activity and relative association, such as *horse—drives a cart*, *ribbon—tie it on your hair*, *lamp—some people can't afford gas and have a lamp* (given in 1.4 sec!). This type has been called AR. When it is grouped with pure Activities, the balance is still maintained between Activities and Relatives, while the number of Qualities remains approximately the same, viz: R, 43.7; A, 29.8; AR, 13.9; Q, 12.6.

iii. At Age 12, however, a great difference is shown. Activities are now relegated to a subordinate position, and the mixed type disappears entirely, while Relatives greatly preponderate. The percentages are: R, 80; A, 10.7; Q, 9.3.

iv. At Age 14, Activities are practically negligible. Relatives still preponderate, but Qualities emerge in a most significant manner. The percentages are: R, 56.9; Q, 38.3; A, 4.8.

Of course, these results are only generalizations. Some 10-year-olds, for example, display the characteristics attributed to

Age 14. But the gradual elimination of Activities is quite certain, and the undue presence of Activities in the answers given by an older child would be a fair indication of backwardness.

Answers given in proportion from all three classes might be expected from the cleverest children. With girls of 12, however, answers consisting entirely of Relatives were obtained from the brightest and cleverest in the class.

3. The problems suggested by perseveration were first outlined by Meumann. He distinguished three different kinds, which Rusk has formulated as P_1 , P_2 , and P_3 . Roughly speaking, P_1 is the repetition of the same word in response to many different stimuli; P_2 is the recurrence of a certain form of expression; P_3 is the recurrence of a certain type of relation (adjectival, etc.) which determines the reproduction.

Meumann asserts that "the degree of perseveration varies inversely with age and intelligence." This sweeping indictment seems indiscreet. In distinguishing these three types of perseveration, some discrimination in the quality of the answers is necessary, especially in cases of P_3 , (Cf. Winteler's classification of mental types). A subject who responds adjectivally to all concrete stimuli may yet give highly characteristic adjectives describing essential qualities, and cannot be classed on the same mental level as one who reacts indiscriminately to various objects with comparatively vague adjectives like *big* or *new*.

Many cases of P_3 have been observed by the experimenter where the varied range of adjectives given points to developed observation and a high degree of intelligence. Only where P_3 is accompanied by P_1 could it be taken as indicative of a low standard of intelligence.

P_1 occurs chiefly in younger pupils who show marked dullness in other respects—*e. g.*, children very slow at reading, and slow to grasp the nature of the response required. P_1 is practically restricted to children of 10 and under: there is a slight tendency towards it in a few girls of 14.

P_2 varies in quality with age. In children of 8 and 10 it is a certain symptom of undeveloped power of expression, coinciding with backwardness in reading; in older pupils and in adults it usually takes the form of word-completion and seems to be of very doubtful value as an index of intelligence. Of course,

where it marks an early approximation to the adult type, unseasonable precocity may be mistaken for cleverness, so that the class-place of the child would be no criterion.

Cases of perseveration were very rare among those children who belonged to the "relative" class and were most frequent in those who gave a preponderance of qualities. In connection with the rate of association it is worth noting that the dull types of perseveration (P_1 and P_2), which save thinking, are sometimes conducive to increased speed.

4. The special capacities of the pupil are shown to a certain extent by the type of imagery predominant in the responses. Visual imagery is the most common. In all the girls of 14 any predominance of color-qualities in the responses coincided with a special aptitude for drawing and painting, shown in the class records. Auditory imagery was practically non-existent in the responses given by children under 12; the girls of 12 and 14 who reacted noticeably with auditory imagery, such as *watch—tick*, *market—noise*, *motor—honk-honk*, *gun—bang*, were without exception good at music. The very few who paused to pick and choose their words in giving an association were found to excel in English. One girl, brilliant at mathematics, who found great difficulty in expressing her imagery, had the same difficulty in English composition.

5. The experimenter was interested most of all in cases of total or partial inhibition—where association of any kind was either wholly absent or present only after an inexplicable lapse of time. Total inhibition occurred only in nervous pupils, but was not caused by conscious shyness or fear. Fatigue or suppressed hysteria may account for it, but the writer's ignorance of the matter is so great that she shrinks from making suggestions. Unfamiliarity with the object presented could not have been the cause, as the most ordinary words such as *horse*, *mat*, *picture*, *watch*, were among those which called up no association whatever. It is also remarkable that inhibition was confined to clever children. The problem of inhibition in association calls for further investigation.

PROBLEMS OF TEACHER MEASUREMENT

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Teacher measurement, in the sense of estimating the efficiency of teachers individually, is not a new and theoretical proposal, but an existing supervisory responsibility. This statement needs no demonstration. But some discussion may be necessary of the further statement, that, in so far as teacher measurement is at all reliable and consistent it must be controlled by some sort of schedule or list of items representing qualities of teaching merit. Such a schedule may never have been set down on paper; indeed, its possessor may hardly be aware of its existence. But it is humanly impossible for a supervisor to report from year to year upon the efficiency of the various members of his teaching staff, accepting the responsibility for their retention, advancement, demotion, or dismissal, and particularly for their assistance and improvement while in service, without having formulated, clearly or crudely, somewhere in his mind, a statement of the factors which in his opinion constitute efficient teaching.

The current efforts of experimentallists in the field of teacher measurement are only attempts to extract from the consciousness of principals and supervisors these personal criteria of good teaching, and to assemble and condense them into a single objective schedule, thoroughly tested, by means of which every judge of teaching may make his estimates more accurate, and more consistent with those of other judges. There is nothing new about the entire movement except the attempt to objectify what already exists subjectively, and to unify and render universal what is now the scattered property of many men.

There are those who believe that the movement toward teacher measurement is a monstrous innovation, which threatens the holiest traditions of the educational profession by putting a premium upon mechanical methodology. It is not an innovation. But the phrase "teacher-measurement," itself, no doubt, is in part responsible for this misunderstanding, as it suggests a mathematical exactness of procedure which is clearly impossible in this field. Teacher measurement will probably never become more than a carefully controlled process of *estimating* a teacher's individual efficiency. The phrase is, however, sufficiently con-

venient and euphonious, and has now been used widely enough, to warrant its continuation.

To students who are familiar with the reports of current studies in this field there occur objections to present procedure of a more fundamental character. However sympathetic one may be with the general plan of devising schedules for teacher measurement, it is difficult to justify many of the methods by which these investigators have attacked the problem. For example, all of them appear to have set up as their goal the construction of a schedule which can be applied to any teacher, whether in the elementary or high school, and irrespective of the grade or subject in which his teaching is being done. "Teaching is teaching," is the evident assumption, "and the same wherever found." But it may reasonably be maintained that different qualities and methods, at least in part, are requisite for a teacher's success in the primary as contrasted with the grammar grades, and that the criteria of good teaching are not entirely the same in the different departments of the high school and of yet higher institutions. In so far as the criteria of good teaching *are* the same in these very diverse situations, it seems probable that the comparative importance to be attached to each must differ. If these contentions are correct, the problem is to devise, not a single blanket schedule for universal application, but a series of independent schedules for teachers of different grades and subjects in the elementary and high schools. If, on the other hand, these statements are not true, and if a single schedule can actually serve in place of many, the surest way to discover that fact is to begin by constructing schedules for specific grades and subjects. Only if the different specific schedules eventually prove to be alike, can a single blanket schedule wisely be substituted for them.

The second major criticism to be urged upon existing studies of this sort is that there is an unnecessary and wholly unjustifiable overlapping among the various items or rubrics comprising the proposed scales. Logically, there are three possible planes upon which an estimate of teaching efficiency may be constructed: (1) the plane of results or of pupil achievement; (2) the plane of the teaching and learning process; and (3) the plane of the teacher's equipment for teaching, both native and acquired. This kind of analysis appears not to have been made by the

investigators whose work has been reported. Certain items in their schedules have been drawn from the plane of results (for example, "the growth of pupils in subject-matter"),¹ others have been taken from the plane of the schoolroom process (such as "skill in stimulating thought"), and still others have come from the plane of the teacher's equipment ("academic" and "professional preparation"). Clearly, in so far as elements in the schoolroom process are real factors in teaching efficiency they are measured once in the measurement of results. To measure them again, independently, is to measure them twice. Similarly, academic and professional preparation, in so far as they have actually affected teaching, and hence have become real factors in efficiency, are measured once when results are measured, are measured again when the teaching process is measured, and are measured yet a third time when measured by themselves. In precisely the same way, results are measured indirectly in the measurement of the teaching process, and are again measured indirectly when one measures the teacher's equipment for his work. Assuming that the various items representing each plane of measurement have been selected at random, but that none of the planes is represented completely by the items chosen, we have no *a priori* means of determining which of the respective items have, in reality, been measured three times, which have been measured twice, and which have been measured only once.

Not only has there been an unrecognized overlapping of the levels of measurement from which the individual items of the schedules have been taken, but there has been equally unrecognized overlapping among the items representing each level. To take a single illustration: In Boyce's scale, among the items representing the plane which we have described as "the teacher's equipment," we find the rubrics "health" and "voice." Ordinary observation alone is sufficient to convince one that health is frequently a large factor in determining both the quality and the control of a teacher's voice. This one illustration could be multiplied many times. Indeed, there is hardly an item in this or in the other scales which does not clearly overlap upon one or more of the other items making up the schedule.

¹ The examples given in parentheses are taken from the tentative schedule proposed by Boyce, in Part II of the Fourteenth Year Book of the National Society for the Study of Education, page 45. Illustrations of the same sort of combination might be drawn from other published schedules.

It would, of course, be a hopeless task to attempt the construction of a schedule in which all of the items would be mutually exclusive. But it is highly desirable, in fact it is necessary, to reduce this overlapping to a minimum, and to utilize such methods as are available to estimate or to eliminate the effects of unavoidable duplication. Investigators in this field have not only permitted the grossest overlapping to occur among the component items of their scales, but they have failed to make use of available methods for eliminating its disturbing consequences.²

In the third place, students of teacher measurement appear to have erred in that they have attempted too much. The writer is strongly of the opinion that, for the present at least, efforts to construct a schedule for teacher measurement should be confined to a single one of the three planes which have been enumerated. Doubtless in the end we shall want to know as much as possible about all three; and to combine in our final estimate of a teacher's merit all attainable facts as to her equipment, her classroom procedure, and the results which she achieves. But at present we should do wisely to project our investigations upon one plane at a time, and to make each of these investigations as thorough as it is possible to make it. Later, when we know the nature and comparative value of the various items necessary to adequate judgment upon all planes, there will be time and opportunity for putting together the different schedules into one.

Let us endeavor to make this matter concrete. Let us suppose that each of the planes referred to contains ten elements of efficiency; in other words, that there are ten elements in the teacher's inherited and acquired equipment, ten elements in an effective teaching process, and ten requisite elements of results. Is it not clear that a schedule made up of ten elements comprising, for example, the plane of the teaching process, would be a more permanent achievement than a schedule made up of ten items distributed over all three planes? A schedule made up of items confined to one plane need not be disturbed by advances subsequently made upon the other planes, but a schedule whose

² Attention may here be called to the mathematical formula known as the "regression equation" which has been used by T. L. Kelley, C. T. Gray, and others, to eliminate the complications arising from the sort of difficulty that we have described.

items are distributed over all three planes must be completely revised with every discovery made upon any plane. The great advantage of confining endeavor to a single level at one time is that results secured upon that level can stand undisturbed by contemporary or future achievements made upon different levels. It is customary and wise to lay the foundation securely before rearing the house, and not to try to construct both the foundation and the superstructure at the same time.

While other cogent reasons might be advanced for urging the concentration of an investigator's energies along a single plane, the one that has been given is sufficient. Without further argument of the point, therefore, let us try to determine which of the three levels offers the best prospect of useful results.

The plane of results (in the sense of changes wrought in pupils) would be the ideal plane upon which to build an estimate of a teacher's individual efficiency, if it were possible (1) to measure all of the results of teaching, and (2) to pick out from the body of measured results any single teacher's contribution. At present these desiderata are impossible to attain. Only the more mechanical products of a teacher's efforts can now be subjected to accurate appraisal, and means exist for the measurement of only a small portion of these. This fact is no indictment of present efforts in the field of educational measurements. Let us continue to measure such results of teaching as we can, and let us by all means extend our facilities for this purpose; but let us not make the mistake of assuming that the results that we can measure are the only results of teaching, or even that they are the most important part.

Moreover, we must keep constantly in mind the fact that the results which pupils achieve in any given subject are by no means the product of the labor of any single teacher. Earlier teachers, other contemporary teachers, and the environment external to the school, are all factors in determining pupil efficiency in any school subject. It has been urged that the influence of these complicating factors can be materially reduced by measuring only the change in pupil achievement which takes place under the guidance of a single teacher. But it must be remembered that this process only reduces these complications; it does not and cannot eliminate them.

It seems clear, therefore, that we are not now in a position to base an estimate of a teacher's individual efficiency upon the measured power of accomplishment shown by her pupils, nor even upon the measured change in the power of accomplishment which takes place under her tuition. We have not the facilities for measuring all of the results of teaching, nor for determining for what part of the measurable results any single teacher is responsible. Under such circumstances, we must turn to the other levels which have been described in search of more encouraging possibilities.

Of the remaining levels, that of the teaching process seems to offer greater promise than that of the teacher's equipment for teaching. The test of a teacher's efficiency is not so much what she *can do* as what she *does*. That teacher is inefficient who is doing inferior work, no matter what the standard of work she may be able to maintain; and that teacher is efficient, though certainly not the most efficient, who is doing good work, irrespective of her ability to better it. But when a teacher's present efficiency has once been ascertained, facts relative to her latent abilities become of great significance, as the means for guiding her progress upward to higher planes of usefulness. The securing of these facts, however, constitutes a separate problem.

Our discussion has now brought us to the level that we have called the plane of the "classroom process." It is upon this plane that the writer recommends immediate and concentrated investigation. This level is superior to the level of results in that it is here possible to differentiate more clearly the activities of a single teacher, and it is superior to the plane of equipment in that it represents actual and not potential efficiency. It is also, in all probability, more readily measurable than the other planes. However, measurement upon this level is not without its serious difficulties.

One of these difficulties is that of defining accurately the meaning of the classroom process. Does it include teacher-activities, or pupil-activities, or both? There is good reason for urging that it be confined to pupil-activities. Pupil-activities alone are responsible for the growth of pupils, and it is for stimulating the growth of pupils that schools and teachers exist. On the other hand, pupil-activities are to no small degree a joint product, due to influences flowing from all the teachers in the school, and

from agencies outside the school. No one teacher can be given the entire blame or credit for the doings of the pupils in her classroom. Only the teacher's own activities represent herself.

The common-sense answer to our question seems to be that the "classroom process" should be regarded as including the activities of both teachers and pupils. This is the meaning adopted by the practical supervisor, who, when visiting a classroom for the purpose of judging the quality of instruction, looks at both teacher and pupils for indications of what is going on. Why should the schedule-maker do less than this? It is the purpose of a schedule, not to rob a supervisor of any of his sources of information, but to guide him in the use of these sources to the end that he may draw from each one all that it has to give.

If the reader accepts the propositions that have been advanced thus far, he should be ready to accept the suggestions which follow for the guidance of future research in the field of teacher measurement. Let the investigator select a single school grade or subject, and confine himself for the time to the elaboration of a schedule for teacher measurement in that alone. Let him also limit his efforts to a single plane of measurement, for the time at least; preferably to the plane of the classroom process. Let him not attempt the visionary task of developing a schedule for measuring all teachers, in all grades and subjects, and upon all planes.

There is one apparent objection to these proposals that should be mentioned. It would be impossible, under this policy, to reduce one's estimate of a teacher's efficiency to a single statement, such as a mathematical per cent. The ratings given a teacher in native ability and preparation, in classroom efficiency, and in results as manifested by the achievements of her pupils in standard tests, would have to be kept strictly independent of each other for a long time to come. Not knowing their relative importance, it would be impossible to transmute these different statements of efficiency into one. But the writer is unable to see that this fact forms a valid criticism. Hasty reduction of these various statements to one is to secure a final statement that is false. Furthermore, what is the practical utility of a single mark for representing a teacher's efficiency? Would any sane supervisor recommend the discontinuation of teacher's services simply because she fell below a stipulated percentage mark in

terms of any schedule? Would any responsible board accept such a recommendation if it were made?

A supervisor's judgment of the final merit of each of his teachers must be formed in the future as it has been formed in the past. Assembling in his mind all of the obtainable facts with regard to a teacher's work, he must form his opinion as to her needs and her deserts in the light of these facts plus his knowledge of the needs of his particular school. The promotion, discharge, or constructive criticism of teachers cannot be reduced to mathematical formulae. The proper function of a scorecard for teacher measurement is not to substitute such a formula for a supervisor's personal judgment, but to aid him in discovering and assembling all the data upon which intelligent judgment should be based.

ABSTRACTS AND REVIEWS

LEWIS M. TERMAN. *The Measurement of Intelligence. An Explanation of and a Complete Guide for the Use of the Stanford Revision and Extension of the Binet-Simon Intelligence Scale.* With an editorial introduction by Ellwood P. Cubberley. Riverside Textbooks in Education. Boston: Houghton Mifflin Company, 1916. Pp. xviii + 362.

In this book Professor Terman has rendered a profound service to society as well as to education and science. The author modestly omits an account of the magnitude of the work which he undertook with but a few associates, and presents only the end products of his labors. The subject of intelligence has never received its due as a basis of educational and sociological theory, but in this book one finds almost the first textbook on the subject. Throughout the presentation the author shows a splendidly sympathetic appreciation and evaluation of the contributions of Binet and Simon and makes repeated acknowledgement to their pioneer researches.

The first three chapters present a general introduction to the purposes and values of intelligence tests and the nature of the Binet-Simon method, with a clear statement of the essential relation of intelligence to pedagogy. Chapters four to seven describe the nature of the Stanford revision and extension of the Binet-Simon Scale, including a detailed discussion of the reliability of the method and the significance of results obtained by its use. This includes a complete statement of the author's attitude toward the "intelligence quotient" (I. Q., the ratio of mental age to life age) as a means of expressing intelligence status.

Part II consists entirely of a complete guide for the use of the Stanford Revision, which is as detailed and as nearly "fool-proof" as such directions could be made. Miscellaneous statistics of standardization are scattered throughout these thirteen chapters. There is an appendix of 89 selected bibliographical references on the use of intelligence tests, classified by subjects, some suggested books for a teacher's private library, and a brief list of American journals of clinical psychology.

The author agrees with Goddard that "not far from two per cent. of the children enrolled" in the public schools "must be looked upon as real defectives," and adds that "the number of children with very superior (intellectual) ability is approximately as great as the num-

ber of the feeble-minded," upon whom "the future welfare of the country hinges in no small degree." The results of investigations in the field of juvenile delinquency and cacogenic families indicate "that the most important trait of at least 25 per cent. of our criminals is mental weakness." The use of intelligence tests is urged as a necessary basis for school grading and for estimating vocational fitness. The intelligence of retarded children is found to be usually overestimated and that of superior children usually underestimated in teachers' judgments. "The retardation problem is exactly the reverse of what we have thought it to be. It is the bright children who are retarded, and the dull children who are accelerated." In these several conditions of social and educational adjustment is found the need for the measurement of intelligence, which must be undertaken by means of *standardized* mental tests.

Terman's description of the nature of the Binet-Simon method of measuring intelligence reveals intimate first-hand acquaintance with the publications of these authors, and contrasts pleasantly with the gross misrepresentations frequently encountered. One finds here an authoritative digest of the Binet-Simon publications which bear on the Measuring Scale. It was the purpose of the Stanford revision to eliminate the statistical inaccuracies of the American standardizations of this Scale, to standardize procedures, to eliminate undesirable tests and substitute others, and to extend the Scale to the valid measurement of adolescent and adult levels of intelligence. The revision and extension are based on the results of individual examinations of approximately 2300 subjects, although only about half of these were used in the final tabulations. Forty tests in addition to those used by Binet and Simon were employed experimentally. It was intended to extend the number of tests to six at each year, but as finally arranged the upper years are presented in two-year intervals, with from six to eight tests per interval. Responses were recorded verbatim so as to permit of revised rescoring. All examiners were carefully trained for technique, and all responses were scored by Terman himself. Apparently these precautions increase the objective validity of the tests and eliminate personal equation of procedure and scoring. The subjects of school age were selected on the basis of average social status, and included all children in these schools who were within two months of a birthday, exclusive of foreign-born children. It may be noted in passing that this method of selection should operate in the direction of producing more consistent results, and should tend to reduce "scattering" to a minimum.

"The guiding principle was to secure an arrangement of the tests and a standard of scoring which would cause the median mental age of the unselected children of each age group to coincide with the median chronological age." The author "had already become convinced that no satisfactory revision was possible on any theoretical consideration as to the percentage of passes" commonly employed in mental test standardization. No doubt the current standardization criteria are far from meeting the demands of scientific exactness, and are in real need of revision, but the alternative method adopted by Terman seems hardly a satisfactory substitute. It leads to conclusions which are in reality only direct corollaries of this hypothesis. Moreover, the tests at each year must be so manipulated as to produce the desired result, and theoretically, at least, if only the end product is considered in this manipulation, many disadvantages might result. Furthermore, since the tests are arranged in a continuous year scale, a succession of years and the intercorrelation of tests must be taken account of. As a matter of fact, however, it appears that much use was made of the percentage criterion, and aside from theoretical objections the results indicate a real increase in reliability of the Binet-Simon method. It is unfortunate that the experimental data on which the revision is based (which is announced for early publication) could not have preceded the publication of the textbook on the use of the revision. For the present, one must accept the revision on faith, and must also reserve judgment on those experimental studies in which the revision is used as a basis. Until the experimental data are available for critical evaluation there is no means of comparing the Stanford revision with other versions of the Binet-Simon Scale, or of comparing results from the use of these scales. Undoubtedly, however, the practical aspects of the matter permit of no room for quibble.

The reliability of each test as a real measure of intelligence was determined by checking the results of each test against the revised scale as a whole. This was accomplished by grouping all subjects into I. Q. groups of below 90, 90 to 109, and above 110. "If a test fails to show a decidedly higher proportion of passes in the superior I. Q. group than in the inferior I. Q. group, it cannot be considered a satisfactory test of intelligence." Inasmuch as the scale as a whole has a demonstrated degree of reliability, this method affords a satisfactory empirical measure of the intelligence value of each test, assuming, it should be held, that the test is located with reasonable

accuracy, for a test may be a good measure of intelligence at one year and not at another.

One thousand intelligence quotients are analyzed and lead to several important conclusions. While agreeing in expectation with some of these conclusions, the reviewer feels that the demonstration is not convincing. To him it appears that the three important conclusions regarding the symmetrical distribution of intelligence (p. 67) result from the standardization hypothesis, at least in part, but in the absence of the complete experimental data (quite properly omitted in the present work, this contention can not be substantiated. There might also result some unexpected error from the selection of the subjects on the basis of average social status. The fact that the socially inferior are numerically greater than the socially superior, and that there is a correlation between intelligence and social class might skew the curves in the direction of inferior intelligence.

It is stated as an inference supported by re-tests of the same children at intervals of two to four years (data not cited) that "a child's I. Q., as measured by this (Stanford) scale, remains practically constant." It is also contended that the I. Q. automatically transforms the "age-grade method" to a "point-scale method." We should expect the advocates of the point scale method to object to this contention. The inference with regard to the constancy of I. Q.'s seems rather hastily made. If correct it would prove an invaluable diagnostic aid. But for the feeble-minded at least, it is improbable that individual I. Q.'s do remain constant. The potentially feeble-minded, for example, contradict this influence—indeed, the type was first defined as those mental defectives who are "at age" intellectually. Neither can the I. Q. be used without specific precautions as a means of classifying mental defectives, unless the I. Q. ratio is *not reduced* to a decimal expression. This point is illustrated by the author's cases. M. S. and R. M. (p. 82) both have I. Q. = .60, but the former has a mental level of 4.5 and is technically an imbecile, while the latter has a mental level of 9.0 and is technically a moron. If the I. Q.'s of these two children were to remain constant to 16 years, the former would ultimately possess a mental age of 9.6 as would also the latter. This expectation is not in accord with experience with feeble-minded children. Nor would it be fair at the present time to consider the two children as similar (which the reduced I. Q. does) when in fact the mental age of the one is exactly twice that of the other. It is the mental age and not the decimal I. Q. which affords a basis for

educational expectation in feeble-minded children. The argument might be amplified by other examples drawn from pages 82 to 86.

Feeble-mindedness is defined by the author as an I. Q. value "rarely above 75." "All who test below 70 I. Q. by the Stanford revision of the Binet-Simon scale should be considered feeble-minded." But the incautious reader must not infer that this I. Q. limit constitutes the sole criterion of feeble-mindedness, except as the intelligence criterion supplements the social criterion, and, as is implicit in the author's statements in other publications, except as the intelligence is the most significant item in the diagnosis of mental defect. Similarly, "borderline," "dull normal," "average," "superior," and "genius" intellectual states are defined in terms of I. Q., supplemented by brief discussion and by case instances. But the reader must consider these I. Q. limits as intelligence classifications and not as mental diagnoses, as might be inferred. I. Q. is found to correlate with social status, with quality of school work, and with grade progress, with the implication that these are expressions of intelligence levels and not causes thereof.

A chapter on "reliability of the method" criticizes the accuracy of the revision from the standpoints of examiners' training, subjects' attitudes, influence of coaching, repetition of tests, and social and educational advantages. This experimental analysis clearly contradicts any serious invalidating effect of these factors so often ascribed to them.

It is beyond the scope of this review to consider Part II in detail. This section is a compendium of instructions, both general and specific, which is as nearly ideal as language and experimental foresight could contrive. The author's extensive experience with the tests and with students thereof has enabled him to anticipate the majority of exceptional difficulties with which the novice is confronted. The standards of procedure and of scoring are for the most part unequivocal and objective, and are at least in some degree experimentally determined. It is unfortunate that the results of the historical study of the Binet-Simon Scale could not be presented. The reviewer understands that a complete tabulation was made preceding the experimental investigations on standardization of the Scale, including procedures used, scores, and results. This colossal work is barely referred to in the present text, although its presentation would be invaluable to research students.

Let us hope that those who in the future employ the Stanford revision will do the new scale the justice of spending at least a fraction of their time in digesting the contents of this book, which leaves them but little excuse for error. Let us hope, too, that with such a careful foundation laid, we may hope to spend less time in future discussing the materials of intelligence testing and give more to its application. From the latter there will necessarily result much that is essential to the former.

E. A. DOLL.

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EDITORIAL

Educational theory needs light from psychology upon several problems. One of the most important of these has to do with what we have been calling "initiative."

INITIATIVE, ORIGINALITY This important mental trait, or complex of traits, is not only frequently referred to in our educational discussions,

but seems to hold the central position in all current constructive doctrines. Traditional precepts of school management, particularly those that emphasize obedience and routine, are criticized on the ground that they tend to crush initiative; the systematic mastery of subject-matter has been condemned on the same basis; and the most significant opposition to a type of vocational education that emphasizes the mastery of skills involves the assumption that skill and initiative are antithetical terms. An outstanding feature of the Gary movement and of Mr. Flexner's proposed "modern school" is the assumed inconsistency of habit and initiative and the consequent neglect of the former and emphasis of the latter.

Theoretical arguments can be advanced both for and against these current assumptions, but it is very difficult to cite scientifically established facts on either side. Is the quality that we call initiative a native mental endowment or is it a product of inspiration and training or is it the resultant of a favorable environment working upon a favorable innate diathesis? If it is thoroughly innate, is it a primary unit character or a mosaic of hereditary factors? If it is either wholly or partially an acquired characteristic, what are the conditions favorable to its development? Is thoroughness of mental mastery inimical to the development of this important trait or is thoroughness an indispensable factor in its growth?

Thorndike, in the *Teachers College Record*, cites his recent studies of engineering abilities as evidence that a high measure of initiative may co-exist with a high measure of routine efficiency. If it can be shown that there is a causal connection between the two factors a start will be made toward the solution of a most important problem, and in any case the suggestion that the two may co-exist in the same individual should be a healthful corrective to the rather dogmatic antagonism toward drill routine, and habituation represented by the Gary and Flexner movements. Certainly no predication of current educational doctrine is so heavily fraught with significance to educational statesmanship as is this assumed antithesis between skill, routine, and thoroughness on the one hand, and constructive ability on the other hand. As an example of its far-reaching potentialities, one may cite the position taken by an ethnologist, Mr. Madison Grant, in a recently published book, *The Passing of the Great Race* (Scribners, 1916). Mr. Grant apparently assumes that both initiative and capacity for routine mastery and efficiency are distinctive and specialized racial traits, neither of which is likely to coexist with the other. His book is fundamentally an argument for the recognition of a privileged class which shall devote itself to administrative and constructive efforts, leaving the routine work to be done by those less favorably endowed. A doctrine which is apparently so thoroughly out of harmony with the ideals of American democracy should certainly challenge investigation.

W. C. B.

NOTES AND NEWS

Announcement is made of the founding of a new *General Science Quarterly*, a periodical devoted to the interests of science teaching in the elementary and secondary schools, to be edited by W. G. Whitman, of the Salem State Normal School.

The faculty of Vassar College has decided that students shall be informed of their marks after examinations, and has adopted the scale of marks A, B, C, D, E, F, with D as passing. The mark A will signify marked ability, and in elementary classes will be given to not more than five per cent. of the students. The mark B will signify "good," and will be given to from twenty to thirty per cent. of the students, C will mean "average," and will include forty to fifty per cent., while E demands re-examination, and F the repetition of the course.

A medical clinic for examining delinquent, nervous, subnormal, and abnormal children has been opened in the university hospital, University of Minnesota. The departments of education, psychology and sociology of the college of science, literature and the arts are assisting in making examinations of these children. The work is directly under the medical school.—*School and Society*.

The California state board of health has prepared a bill providing for the establishment of a state psychopathic hospital in San Francisco near the University of California Medical School. The hospital will provide a research laboratory and treatment for patients requiring special or intensive study for a short period.—*Science*.

At the Royal Institution, London, Professor C. S. Sherrington is giving a course of six lectures on "The Old Brain and the New Brain, and Their Meaning."—*Science*.

On Monday evening, February 26, the New York Branch of the American Psychological Association met at Columbia University. The following papers were read: "The Effect of Method of Presentation on Immediate Memory for French Vocabulary" by C. E. Farnum; "Correlation of Interest and Ability" by J. D. Jackson; "Psychological Analogy in Political Theory" by J. P. Turner; "The In-

fluence of Mental Set upon Association" by M. A. May; "Maze Experiments with White Rats" by G. J. and H. A. Ruger.

A bulletin dealing with the use of standard measurements of reading, handwriting and arithmetic in the public schools is to be issued by the Bureau of Educational Measurements and Standards of the Kansas State Normal School at Emporia.

A special four weeks' course in the scientific determination of musical talent is announced by Professor C. E. Seashore at the University of Iowa from July 30 to August 24. The course will consist of a daily lecture on the psychology of musical ability, and two hours a day devoted to experimental and practical work in the measurement of musical talent.

Edward Thompson Fairchild, president of New Hampshire College, died on January 23. President Fairchild was state superintendent of public instruction in Kansas for five years before going to New Hampshire, and was President of the National Education Association in 1912-13.

On January 26 Superintendent Ben Blewett, of St. Louis, died suddenly of heart failure while he was addressing a committee of the Congress of Constructive Patriotism. Superintendent Blewett was connected with the St. Louis schools for many years, serving as assistant superintendent and as superintendent since 1897. He was a man of kindly, lovable disposition, and one of the broadest minded school superintendents in the country.

Dr. William Healy, for eight years director of the Juvenile Psychopathic Institute in Chicago, has accepted an appointment as psychopathologist on the Judge Harvey Baker Foundation in connection with the Boston Juvenile Court.

Wilford M. Aiken has been appointed assistant professor of the principles of education, and E. Leigh Mudge instructor in psychology, in Ohio State University.

Miss Bessie Lee Gambrill has been appointed head of the department of psychology at the Trenton, New Jersey, State Normal School.—*Atlantic Educational Journal*.

PUBLICATIONS RECEIVED

LEONARD P. AYRES. *The Cleveland School Survey (Summary Volume)*.
Cleveland: The Survey Committee of the Cleveland Foundation, 1917. Pp. 363. Fifty cents.

In this volume the director of the survey sums up the history of the investigation, the methods pursued, and the results that have been presented in greater detail in the other twenty-four volumes of the series. Among the more interesting chapters for the psychologist are IV, New Contributions to Education, resulting directly from the survey; VI, The Teaching Staff; VII, What the Schools Teach and Might Teach; VIII, Measuring the Work of the Public Schools; IX, Health Work in the Public Schools; X, Schools and Classes for Exceptional Children; XII, Education through Recreation; XV, The Public Library and the Public Schools; and XIX, School Organization and Administration. It is noteworthy that while much is said about exceptional children this always means defective children, and that there is not a word about the education of exceptionally bright children—the class whose education is by far the most profitable investment for society.

BIRD T. BALDWIN, and others. *A Survey of Psychological Investigations with Reference to Differentiations between Psychological Experiments and Mental Tests*. Report of the Committee of the American Psychological Association on the Academic Status of Psychology, 1916. Pp. 34.

This pamphlet presents the results of a questionnaire investigation in which the views of 115 members of the American Psychological Association were secured on the relation between psychological experiments and mental tests. The author summarizes the findings as follows: "In general, psychological experiments and investigations aim to promote psychology as a science, formulate general facts and principles, discover new truths, analyze facts of consciousness and behavior in order to secure types or averages and obtain data for an analytic, systematic science. Mental tests represent the applied side or the technology of psychology, emphasize individual differences and attempt to diagnose or measure what is known and to determine the qualitative growth of mental traits from year to year for individuals and groups. They are based on empirical standardizations; they are not as a rule elaborated in process of application; they supplement and throw light on the theoretical problems underlying the science and if viewed critically they become material for psychological investigations."

GEORGINE BURCHILL, WILLIAM L. ETTINGER, AND EDGAR DUBS SHIMER. *The Progressive Road to Reading*. Boston and New York: Silver Burdett and Company, 1916. Book I, pp. 128, 32 cents. Book II, pp. 160, 40 cents. Introductory Book III, pp. 176, 40 cents. Book III, pp. 192, 45 cents. Introductory Book IV, pp. 240, 48 cents. Book IV, pp. 288, 50 cents. Book V, pp. 320, 55 cents. Plan of Work, pp. x, 98, 25 cents.

"The Progressive Road to Reading method is based on the fundamental principle that reading consists in getting thought from written or printed symbols. From the very beginning the sentence is the unit of thought, and the relation among words is never lost sight of." Stress is laid on the content of the reading matter, and on the psychological response awakened in the mind of the child. Throughout the entire series the selections are characterized by their marked literary element and by the appeal which they make to the child's imagination.

MABEL COOK COLE. *Philippine Folk Tales*. Chicago: A. C. McCurg and Company, 1916. Pp. xv, 218.

These tales were collected by the author in the course of a four years' residence in the Islands, and are the first publication of Philippine folk lore in popular form. - Here we have tales of the creation, of the deluge, of transformations into animals, of spirits, gods, heroes, men, beasts, and devils. It is a most admirable collection, and footnotes show the connection between the incidents of the tales and the folk lore of other countries.

GEORGE V. N. DEARBORN. *College Entrance Mathematics*. Reprinted from *School and Society*, 4: 1916, p. 634.

The author attacks the present requirement of algebra for college entrance as useless, time killing, and destructive of interest. Geometry, he believes, has some value, but, following algebra as it does, it is "made to seem more or less horrid by association." There may be disagreement about the relative value of algebra and geometry, but it seems quite obvious that college entrance mathematics is destined to receive a thorough overhauling in the near future.

E. A. DOLL. *Anthropometry as an Aid to Mental Diagnosis. A Simple Method for the Examination of Sub-Normals*. Publications of the Training School at Vineland, New Jersey, Research Department, No. 8, February, 1916. Pp. 91.

This monograph is intended as an aid to the diagnosis of the feeble-minded, rather than as a contribution to anthropometry proper. The data include the results of 477 sets of measurements, embracing height (sitting and standing), weight, right and left hand grip, and vital capacity. The results are presented by mental age groups,

with the chronological age indicated in each case. In all the measurements the feeble-minded are distinctly below the normal. This is most strikingly the case in vital capacity, and least so in weight. Many of the groups of girls are above the normal in weight. There is a close correlation between the psycho-physical average and mental age. An appendix of 12 pages gives Smedley's percentile tables for school boys and girls in the traits here considered. The monograph is a valuable addition to our knowledge of the feeble-minded, and will be widely used for reference.

J. GORDON DORRANCE. *The Story of the Forest*. Cincinnati: The American Book Company, 1916. Pp. 237.

This little book tells how trees live and die, how to know the trees, how the logs are brought to the mill, and how paper, charcoal, tanbark, turpentine, and maple sugar are gotten from trees.

A. A. DOUGLASS AND W. L. DEALEY. *Micromotion Studies Applied to Education*. Reprinted from the Pedagogical Seminary, 23: 1916, 241-261.

The authors contend that the use of moving picture films to record the finer adjustments in behavior will be a valuable supplement to present scales in education.

CHARLES REDWAY DRYER. *Elementary Economic Geography*. Cincinnati: The American Book Company, 1916. Pp. 415.

The first part of this book treats of human economies and their natural foundations, as plant, mineral, and marine resources, industry, and trade. Part two discusses the resources of the chief geographical divisions of this country.

ARTHUR WILLIAM DUNN. *The Social Studies in Secondary Education*. Bulletin, 1916, No. 28. Washington: Bureau of Education, 1916. Pp. 63. Ten cents.

This is the report of the committee on social studies of the commission on the reorganization of secondary education of the National Education Association. It provides a six-year program adapted to both the 6-3-3 and the 8-4 plans of organization. The report is a noteworthy contribution to the aims and methods of teaching history.

FREDERIC ERNEST FARRINGTON. *Public Facilities for Educating the Alien*. Bulletin, 1916, No. 18. Washington: Bureau of Education, 1916. Pp. 51.

The bulletin gives a brief account of evening schools, supervision, teaching staff, publicity methods, and other aspects of the effort that is being made to assimilate our illiterate immigrant population.

ALFRED LAWRENCE HALL-QUEST. *Supervised Study. A Discussion of the Study Lesson in the High School.* New York: The Macmillan Company, 1916. Pp. xvii, 433. \$1.25.

The author states that the aims of the present book are as follows: "(1) To formulate a tentative conception of supervised study; (2) to indicate what should be included in a course on teaching the high school pupil how to study; (3) to describe in detail the various schemes of organization by which the supervision of study is administered in a large number of schools; (4) to apply the principles and methods of supervised study to some of the subjects in the high school program; (5) to summarize the results of the more significant investigations aiming to prove the effectiveness of supervised study; (6) to collect the data on supervised study that have appeared in several periodicals within the last five years and that may not have been accessible to the majority of teachers." These aims seem to have been realized with a considerable degree of success, and the book will repay careful study by the high school teacher.

DWIGHT LOWELL HOOPINGARNER, TRUMAN LEE KELLEY AND LEROY WALTER SACKETT. *Laboratory Experiments in Educational Practice.* Austin, Texas: Published by the Authors, 1916. Pp. 95.

This laboratory manual in educational psychology is an advance edition for use in the authors' classes, and represents an attempt to furnish elementary students with an introduction to experimental procedures in education. A glance at the table of contents (control of association, memory, imagination, the perceptual process, the higher thought processes, the control of attention, motor learning, suggestion, individual differences and mental measurements) shows that the book rests on the traditional classifications of psychology, and a closer inspection of the exercises leads one to question the immediacy of their connection with educational practice. There are experiments with paired associates, free association, opposites, part and whole learning, effect of pauses in memorizing, simple versus intricate material in memorizing, recall of definitions, vividness of imagery, effects of multiple presentation in spelling, contrast illusions, effect of mental attitude upon perception, word completion test, practice without knowledge of results, concept formation, factors in the control of attention, mirror tracing, and correlations of mental traits. In order to prevent anticipation of the experiments by the students, the leaves of the manual are fastened together like a pad, and are not to be opened until the instructor so directs. The book is an interesting attempt at the selection of class experiments that will be of value for students of education, but could be improved by drawing the materials more largely from schoolroom work.

ARTHUR W. KALLOM. *Standards in Silent Reading, with Suggestions on how Teachers may Test Their Pupils in Silent Reading.* Bulletin No. XII of the Department of Educational Investigation and Measurement. Boston: Printing Department, 1916. Pp. 24. Seven cents.

The first part of this report gives an account of the efforts made by the Boston school authorities to improve the work in oral and silent reading, presents the results of the application of the Kelly reading tests to 118 pupils in grades IV to VIII, and describes the W. S. Gray oral and silent reading tests. The second part contains a series of selections chosen by a committee of teachers to serve as standards for the grades mentioned. The pupils are to be tested both by reproduction and by questions. Directions are given for scoring the results and for measuring the improvement of individuals and classes, but there are no records of the application of the tests.

THOMAS HUNT MORGAN. *A Critique of the Theory of Evolution.* Princeton: Princeton University Press, 1916. Pp. x, 197. \$1.50.

This is a valuable survey of the past theories and present knowledge of evolution by one who has made noteworthy contributions to that subject in recent years. Chapter I outlines the four great historical speculations ascribing evolution to (1) the environment, (2) use and disuse, (3) the unfolding principle, and (4) natural selection, and sketches the evidence for evolution adduced from comparative anatomy, embryology and paleontology. Chapter II discusses the bearing of Mendel's discoveries on the origin of heredity, and illustrates the points with instances drawn from recent experimental findings. Chapter III deals with the factorial theory of heredity, the behavior of the chromosomes, and the composition of the germ-plasm. According to the author's calculations the germ-plasm of *Drosophila*, the fruit fly, contains something like 7500 different kinds of factors. Chapter IV considers the Darwinian theory of natural selection in the light of these studies, and concludes that "natural selection, as here defined, means both the increase in the number of individuals that results after a beneficial mutation has occurred (owing to the ability of living matter to propagate) and also the preponderance of certain kinds of individuals in a population that makes some further results more probable than others." The causes of mutations are still as far from our grasp as ever.

Report of an Inquiry into the Administration and Support of the Colorado School System, made under the Direction of the United States Commissioner of Education. Bulletin, 1917, No. 5. Washington: Bureau of Education, 1917. Pp. 93. Ten cents.

This report discloses many unsatisfactory conditions in Colorado schools. The rural schools are poorly constructed, badly equipped,

and unsanitary, the teachers are selected for anything but their professional qualifications, the course of study is ill-adapted to the needs of the pupils, and there is practically no supervision. Little seems to have been done in the way of school consolidation. Important recommendations are made for systematic administration and supervision of the schools, and for their more adequate financial support.

DAVID SNEDDEN. *Problems of Secondary Education*. Boston: Houghton Mifflin Company, 1917. Pp. xiv, 333. \$1.50.

In view of the avowedly unsatisfactory condition in which many high school subjects are found at present this vigorous and direct treatment of high school problems will challenge attention. For the sake of informality and a somewhat more personal expression of his views the author has thrown what he has to say into the form of letters to various school officials. There are twenty-five of these, directed to all sorts of people from the president of the university to the teacher of physical training. Both the high school and the college are educational agencies for the benefit of the people, and neither should dominate the other, but both should study their problems from a scientific point of view in order that they may coöperate to secure adequate continuity and thoroughness in study and the greatest flexibility in meeting the needs of the individual student. Throughout the book emphasis is laid on the necessity of scientific study of high school problems, whether the person addressed be the college professor of education training teachers for high school work, the principal of a regular or industrial high school, the entire high school teaching body, or the teacher of Latin, English, history, mathematics, physics, biology, music, home economics, or manual training. Many of the concrete problems are set forth in clear and definite fashion, and the author's opinion is given for what it is worth.

ISIDORE SPRINGER. *Teachers' Year Book of Educational Investigations*. New York: Department of Education, Division of Reference and Research, 1916. Pp. 53.

The present year book, which is the third issued by this division, contains in part I a summary of recent publications on educational scales and measurements, and in part II a discussion of topics in teaching efficiency and school organization. The investigations summarized include Buckingham's list of problems in arithmetic; Witham's, C. T. Gray's, and Starch's studies in handwriting; Ayres' and Starch's spelling scales; Childs' application of the Thorndike drawing scale; the Starch grammar scales; and the Kelly and Starch reading tests. The section on teaching efficiency reports Shiels' investigation of teachers' ratings, Boyce's efficiency record, and the score-card for classroom observation devised by the Bureau of Municipal Research. Brief mention is made of Greany's and Springer's studies on the results of vocational guidance of grammar school pupils, Springer's study of retardation and ideational type, and other studies of teachers' marks, size of class, and supervised study.

WINIFRED SACKVILLE STONER. *Manual of Natural Education*. Indianapolis: The Bobbs-Merrill Company, 1916. Pp. 216.

The author's ten commandments for natural education are: Never give corporal punishment, never scold, never say "Don't," never say "Must," never allow a child to say "I can't," never refuse to answer a child's questions, never frighten a child, never ridicule or tease a child, never allow a child to lose self-respect or respect for his parents, never banish fairies from home. Other important principles for which the author contends are training for parenthood, teaching children how to play, encouraging children to teach what they have been taught, teaching all languages by the natural method before the twelfth year, teaching facts by means of jingles, early use of the typewriter in teaching the mechanics of language, mental work for early years and mental rest for the adolescent period. The book contains many more interesting and novel suggestions for primary education, and will repay careful study by any mother or teacher.

GEORGE D. STRAYER. *Some Problems in City School Administration*. Yonkers-on-Hudson: The World Book Company, 1916. Pp. xi, 225. \$1.50.

This is the latest number of the School Efficiency Series, and presents the results of the Butte school survey. The book is divided into two parts, of which Part I deals with such administrative problems as organization of the school board, relation of the board to the superintendent, selection and training of teachers, the salary schedules, school buildings and equipment, school census and attendance, and school records. Part II is of greater interest to the psychologist, dealing as it does with the instructional problem. There are studies of the amount and causes of overage, special classes, failures by subjects, estimates of the quality of instruction, a detailed examination of the courses of study, tests of the achievements of pupils, the supervision of instruction, and the adaptation of the schools to the needs of the community. In pupil measurements the Ayres spelling lists were used, and the results by grades ranged from five to fifteen per cent. above the average for twenty-two cities. The compositions, rated by the Hillegas scale, showed a tremendous amount of overlapping from grade to grade, and were very much lower than those of corresponding grades in New York and Maryland. Penmanship, rated by the Thorndike scale, showed an even greater amount of overlapping, and the Courtis arithmetic tests, Series B, gave a similar picture, but showed an efficiency superior to that found in other cities in all operations except addition.

E. L. THORNDIKE, W. A. MCCALL AND J. C. CHAPMAN. *Ventilation in Relation to Mental Work*. Teachers College Contributions to Education, No. 78. New York: Teachers College, 1916. Pp. 83. \$1.00.

This is a report of a series of experiments carried out under the auspices of the New York State Commission on Ventilation, and

deals with the effects of the conditions of the air upon mental work, upon the rate of improvement of mental functions, upon the accuracy of judgment, and upon the choice of alternatives to mental work. The results from the experiments were consistently negative. "When an individual is urged to do his best he does as much and does it as well, and improves as rapidly, in a hot, humid, stale and stagnant air condition as in an optimum condition. This result was obtained when the individuals were subjected to the bad air conditions four hours a day for five consecutive days. Enough individuals were tested to make the result entirely reliable." It would seem from this study that the current teachings of textbooks and medical journals on the depressing effects of bad air for mental work need to be scanned with a skeptical eye, as resting on sentiment rather than fact.

C. W. VALENTINE. *An Introduction to Experimental Psychology in Relation to Education*. Second Impression. Baltimore: Warwick and York, Inc., 1916. Pp. x, 194. \$1.10.

The fact that in less than a year after its issue a second impression of this little book has been called for is a good index of the favor with which it has been received. The reasons for this popularity are doubtless the simplicity and practical nature of the experiments, and the compactness and directness of the discussions. Of especial interest are the experiments on learning vocabularies, on the value of a map, on the accurate evaluation of errors in mirror tracing, on motor memory, on mental multiplication, and on the apprehension of numbers.

J. E. WALLACE WALLIN. *Psycho-Motor Norms for Practical Diagnosis*. Psychological Monographs, Vol. 22, No. 2. Whole No. 94. 1916. Pp. v, 102. \$1.00.

The sub-title of this monograph, "A Study of the Seguin Form-Board, Based on the Records of 4072 Normal and Abnormal Boys and Girls, with Yearly and Half-Yearly Norms," is more descriptive of its scope. The various chapters deal with the increase of psycho-motor capacity with chronological and mental age, its relation to grade of intelligence, sex differences, the influence of familiarity and repetition, and the amount of variability. While there is some discrepancy between the findings of different investigators, there is a general agreement that formboard performance improves steadily with chronological age in normal children, and with mental age in feeble-minded children. Boys are superior to girls, and this superiority seems more marked with increasing intelligence. There is a constant and marked improvement with repetition, and this is greater with sub-normal than with normal, with duller than with brighter children. The more intelligent are able to make a speedier initial adjustment, and thus their earlier records are relatively nearer their maximum. The variability is greater for sub-normal than for normal children, and decreases with practice in both groups.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A CRITICISM OF THE YERKES-BRIDGES POINT SCALE, WITH ALTERNATIVE SUGGESTIONS¹

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INTRODUCTION

In the Yerkes-Bridges Point Scale the "all-or-none" method of scoring intelligence is replaced by a method which gives partial credit for partial answers presumably in proportion to merit. The avowed purpose of the Point Scale as stated on page 9, is that "It brings out the full value of the test material without increasing the expenditure of time and energy."

The purpose is undoubtedly a laudable one. Certainly, much valuable data are unused by the all-or-none method of scoring. If one child puts the form board together in ten seconds and another takes three minutes to perform the same task, it would seem that there is a difference of intelligence between the two which would be well worth taking account of, and that it is a needless disregard for accuracy to give the same score to each. It is all too difficult to get sufficiently accurate data as it is. It is not urged that more accurate data be necessarily gotten, but that all that is gotten be used if convenient.

In the opinion of the writer, however, the method used in scoring with the Point Scale fails entirely to accomplish the purpose sought. The criticisms that are to be made are of such a nature that it has seemed impractical to attempt to make them without first giving a rather full outline of the requirements of a valid point scale, as conceived by the writer, in the light of

¹R. M. YERKES, J. W. BRIDGES AND ROSE S. HARDWICK. *A Point Scale for Measuring Mental Ability*. Warwick and York, 1915.

²The writer is indebted to Dr. Lewis M. Terman of Stanford University for many helpful suggestion in the preparation of this paper.

which it is believed the criticisms can be made more clearly and easily.³

CONSIDERATIONS REGARDING THE CHOICE OF UNITS FOR A SCALE OF INTELLIGENCE

Although the word "intelligence" as employed by Binet was originally used to denote those mental qualities, differences of which differentiated the "feeble-minded" from the "normal," the general assumption underlying the universal use of the Binet Scale is that these are the same mental qualities, differences of which differentiate older normal children from younger. This is the same as saying that children, in maturing mentally, virtually pass through the various stages of intelligence from what would be for adults feeble-mindedness up to normal-mindedness—they mature in intelligence. It has been found, however, that in terms of "mental age" derived from the number of tests passed, children mature in intelligence at different rates. Those who mature rapidly are called "bright," those who mature slowly, "dull." The general conception is also that the yearly increments of intelligence decrease with age, so that intelligence approaches a maximum at a certain age, perhaps not far from 18, and presumably approximately the same for all persons, this being called the "age of maturity of intelligence." Test results suggest that if we had perfect measures of the intelligences of a very large number of children of each age we would find them distributed for each age approximately according to the law of normal distribution; and, as would follow from what was said above, children who are above or below normal (median for their age) have degrees of intelligence comparable to that normal for older or younger children. Children of the same degree of intelligence (mental age) but of different ages may be said to differ in "brightness."

Although originally, no doubt, the word intelligence was intended to apply only to what we have called "brightness," practically every writer on Binet testing has come to use the word, intelligence, also to mean that which is measured by the mental age (of children as well as of adults). Therefore, it has seemed

³ Since writing this article (April, 1916) the writer has undertaken to make a point scale along the lines indicated. It has seemed advisable, therefore, to omit some mathematical proofs and other detailed considerations which will be given in the description of the completed scale.

necessary to adopt a new term, brightness, to denote that in which children may differ who have the same intelligence—mental age. Brightness would therefore be measured by an intelligence quotient.

Standard 10-year intelligence being generally defined as the median 10-year intelligence, or that degree of intelligence possessed by⁴ 50% of unselected 10-year-olds, a child of any age possessing this degree of intelligence is said to have a mental age of 10 years. This method of characterization of an individual's degree of intelligence, however, is not adequate, since by it there is no way of expressing the degree of intelligence which is above that normal for adults.

While it will not be known what exact relation exists between a child's degree of brightness at one age and his degree of brightness at another age until the same children have been tested repeatedly in successive years with very exact tests, it is quite probable, and we shall assume, that degrees of "brightness" are theoretically constant for a given child, being a fixed character of the endowment, so that a child who is really below normal at one age will be so at all ages, and that an adult who is above normal was as much above normal relatively at any stage of development. The indications of data thus far gathered tend to confirm this theory. Its truth is, in fact, the foundation of our hopes in testing intelligence, for if it is not true, in part at least, we can not prognosticate, and intelligence measurement will be of no great value.

In stating that intelligence is assumed to approach a maximum, or maturity at some age, say 18, we are, of course, considering what we might call the *absolute* amount of intelligence, as measured in theoretically equal units, as distinguished from being measured on a year scale. Yearly increments of growth of intelligence are equal, of course, in the sense that years are equal, but not in absolute amount, unless perhaps during childhood.

It is customary among writers to denote the degree of brightness of a child in terms of an "intelligence quotient" (I Q), which is the quotient obtained by dividing the actual mental age of an individual by the mental age normal for his chronological age.

⁴ The expression "that degree of intelligence possessed by," will be used hereafter to mean "that degree of intelligence which is equalled or exceeded by the degree of intelligence possessed by," etc.

This amounts to dividing by the chronological age in all cases in which the latter is not above the age of maturity of intelligence. Thus a child of 10 having a mental age of 12 has an I Q of $12/10$ or 1.20, or an adult of 30 years having a mental age of 15 has an I Q of $15/30$ or .50 (assuming 18 years to be the age of maturity of intelligence). This method involves two difficulties; first, by virtue of the above mentioned limitation on the mental age method of expressing degrees of intelligence and second, because an I Q of $15/18$ is very probably not equal to an I Q of $5/6$ since 15-year mental age is very probably much closer to 18-year mental age relatively than 5-year mental age is to 6-year mental age.

The first of these difficulties has been met by assigning arbitrary mental ages above that of maturity to designate the degrees of intelligence above that normal for the age of maturity. At best, however, this method is objectionable.

Terman and Stern have found, however, by successive testing of the same individuals that I Q's gotten by dividing mental by chronological age do remain fairly constant up to the age of 14, which, if we make the hypothesis that degrees of brightness are constant, would indicate that the yearly increments of intelligence are to be considered as equal absolute units up to about the age of 14.

For the purpose of getting a clear idea of the nature of the intelligence of an abnormal child, it is well to express his degree of intelligence in terms of the normal intelligence for other ages or, in other words, in terms of mental age. Thus, it is very significant to say that a 10-year child has an intelligence which is normal for a child of 7 years or of 13 years, or, as we say, that he has a mental age of 7 years or of 13 years. But on account of the above mentioned defects of this method for purposes of comparison of degrees of brightness of children of different ages, it would seem very desirable, if a 10-year child deviates from the average, to be able to say that he has an intelligence which exceeds that possessed by 65% of 10-year-olds or only 35% of 10-year-olds, etc.

If it may be assumed, as would seem reasonable in the light of facts to date, that if a 10-year child exceeds 65% of 10-year-olds in intelligence, he has exceeded and will exceed 65% of children of his age when at any other age, including adulthood,⁵

⁵ The determination of the degree of approximation of this assumption to the truth, as has been said, awaits the testing of the same individuals through successive years.

then this method of expressing the degree of brightness of an individual becomes very convenient for purposes of comparison or prognostication. Thus we may say that a 10-year-old exceeding 65% of 10-year-olds in intelligence is of the same degree of brightness as a 13-year child or as an adult if either of these exceeds the same percentage of persons of his age in intelligence. Also we may say that he is "brighter" than an individual of any age who exceeds a lesser percentage and "duller" than one who exceeds a greater percentage. The maximum ultimate attainments in test performances of any child upon reaching maturity can thus be predicted from his rank at any age and a knowledge of the ability of adults of the same rank.

For reasons which will appear later, it will be found best to deal principally with intelligence as measured on an absolute scale. Since in measuring intelligence we begin by finding the degrees of performance in certain tests which a person may accomplish, and end by stating his mental age or the percentage of persons of his chronological age whom he exceeds in intelligence, it will be seen therefore that an absolute scale of intelligence may be graduated somewhat arbitrarily since it is only a means to an end, upon the attainment of which the arbitrary scale itself is no longer in evidence.

For the purpose of expressing the different absolute degrees of intelligence in tangible units, let us begin with that degree which is normal for adults—that which is possessed by 50% of unselected adults—and call this an absolute intelligence of grade 100. Then assuming the distribution of absolute grades of intelligence to be normal we could represent that grade possessed by 75% of adults as a grade of 90 and that grade possessed by but 25% of adults as a grade of 110. The unit difference in absolute intelligence is thus defined as $\frac{1}{10}$ of the quartile of the distribution of absolute degrees. According to this definition, the correspondence between the grades of general intelligence denoted by the values 60, 70, etc., representing respectively $-4Q$ (Q = quartile), $-3Q$, etc., of the distribution, and the percentages of adults which theoretically would possess those values would be as shown in Table I.

TABLE I

Grade of general intelligence.....	60	70	80	90	100	110	120	130	140
Point in the distribution.....	$-4Q$	$-3Q$	$-2Q$	$-Q$	C.T.	$+Q$	$+2Q$	$+3Q$	$+4Q$
Percentage of adults possessing these..	99.7	98	91	75	50	25	9	2	0.3

So far we have only defined hypothetical absolute degrees or grades of intelligence in terms of an arbitrary scale. We may be permitted to do this irrespective of what degrees of performance in any test denote the grades of absolute intelligence and irrespective of the percentage of children of any age possessing any absolute grade of intelligence. It is not even essential that the distribution of grades of adult intelligence be normal as measured in any of the natural units such as dollars of earning capacity, or digits remembered, or words in vocabulary or even mental age. The absolute units of intelligence are purely hypothetical and are so defined that the distribution of grades of adult intelligence *will be normal*.

In the sense in which the absolute grades of intelligence possessed by unselected adults fall into a normal distribution, the absolute increments of intelligence composing the units of the absolute scale are equal increments, and in this sense, therefore, an individual possessing the absolute grade of 120 is as much more intelligent than one possessing a grade of 110 as the latter is more intelligent than one possessing a grade of 100, etc. This suggests a more mathematical measure of the degree of brightness.

Thus, to express the degree of brightness of an adult of absolute grade 120 in comparison with the normal adult grade of 100, we might divide 120 by 100 and say the individual had a degree of brightness or *coefficient of brightness* of 1.20. An adult possessing a grade of 110 would therefore have a coefficient of brightness of 1.10, etc. The first is therefore as much brighter than the second as the second is brighter than a normal adult. Such a fact could not be determined when brightness is expressed in terms of percentage rank in intelligence. The coefficient of brightness of a child would then be expressed as the quotient obtained by dividing the absolute grade of intelligence possessed by him by the absolute grade which was normal for children of his age.

Having so made an arbitrary absolute scale of intelligence, however, it would not follow that an individual's coefficient of brightness in these terms would be constant. That is, we do not know that an intelligence grade of 80 in these terms would bear the same proportion to one of 100 that one of 60 would to one of 75, although the first is in each case $\frac{4}{5}$ of the second in terms of our arbitrary scale. This is because we do not know

that we have chosen our units so that zero on the scale represents "just not any intelligence" or true absolute zero.

A possible method would be the following if we may assume that the distributions of intelligences of children of any given age, when measured on an absolute scale, are "normal," and that if the units are properly chosen these distributions will have the same coefficients of variation (such coefficient being taken as the quartile value divided by the median). Such an assumption is merely a corollary to the assumption that degrees of brightness are constant for a given individual. The method would then be merely to find the difference between median adult intelligence and true absolute zero, as a multiple of the Q value (quartile distance on the scale) and then to change the number of units in Q from 10 (arbitrarily assigned) to that number which will make the above mentioned difference 100.

Terman⁶ has pooled the I Q's of 1000 unselected children and finds them distributed as shown in Table 1A. Here we note that 75% of individuals reach an I Q of .92 while 25% reach 1.08, meaning that the quartile distance on the scale of I Q's is .08 points. The percentages corresponding to the positive and negative multiples of Q are very near the theoretical values to be expected in a normal distribution as may be seen by comparing Tables 1A and 1B. If the yearly increments of intelligence are fairly equal in absolute units up to the age of 14, these data would incline us to believe that the median intelligence of individuals of any given age in true absolute units is not far from $12\frac{1}{2}$ times the quartile distance in the distribution of those values. This would mean that the Q of the distribution of adult intelligences should perhaps be 8 units. If that were the case (which let us suppose for illustration) the percentages of adults possessing the various grades of intelligence by the true absolute scale would be as shown in Table 1B.

TABLE 1A

Showing the Percentages of 1000 Unselected Children Reaching Various Intelligence Quotients, as Found by Terman

Percentages of									
Children.....	99	98	97	95	90	85	80	75	66 $\frac{2}{3}$
Corresponding									
I Q's.....	.70	.73	.76	.78	.85	.88	.91	.92	1.00
Percentages of									
Children.....	33 $\frac{1}{3}$	25	20	15	10	5	3	2	1
Corresponding									
I Q's.....	1.06	1.08	1.10	1.13	1.16	1.22	1.25	1.28	1.30

⁶ LEWIS M. TERMAN. *The Measurement of Intelligence*, 1916.

TABLE 1B

Showing the Theoretical Percentages of Adults Attaining the Various Absolute Grades of Intelligence, the Quartile Value of the Distribution Being Taken as 8 points with Median at 100

Grades.....	60	62	64	66	68	70	72	74	76	78
Percentages	99.96	99.93	99.88	99.79	99.65	99.43	99.09	98.58	97.85	96.82
Grades.....	80	82	84	86	88	90	92	94	96	98
Percentages	95.41	93.54	91.13	88.11	84.41	80.04	75.00	69.35	63.21	56.70
Grades.....	100	102	104	106	108	110	112	114	116	118
Percentages	50.00	43.30	36.79	30.65	25.00	19.96	15.59	11.89	8.87	6.46
Grades.....	120	122	124	126	128	130	132	134	136	138
Percentages	4.59	3.18	2.15	1.42	0.91	0.57	0.35	0.21	0.12	0.07
Grade.....	140									
Percentage.	0.04									

CONSIDERATIONS REGARDING THE SELECTION AND USE OF TESTS

Before we can find the percentages of children of different ages who possess the different absolute grades of intelligence as defined, it will be necessary to have an objective means of determining the grades of intelligence of adults and children. It is this purpose, of course, which "tests" serve. Now the tests may be such as are scored simply as right or wrong and the grade of intelligence indicated by the number of tests "passed" or answered correctly. This constitutes what is called the "all-or-none method" which is used to a large extent in the Binet Scale and which is condemned by Yerkes and Bridges.

Another method is that of defining degrees of performance in a single test and determining the grade of intelligence from the degree of performance achieved. It is this method which is believed by the writer and presumably by Yerkes and Bridges to be superior to the all-or-none method, since, as has been said, the degree of a performance such as the quickness of putting together a form board, is of additional significance to the mere fact of its having been put together and since it is no more trouble appreciably to take the time than not to do so.

It should be noted that the second method is used to some extent also in the Binet scale, in that different degrees of performance are recognized and scored as such in a number of tests, such as the vocabulary, fables, memory for ideas, picture interpretation, etc. These will be considered at length later.

Since it is evident that where different degrees of performance in a test may be easily determined and are believed to be significant, they should be taken into account, let us consider the making of a scale or series of tests for measuring the degrees of each of the various abilities of an individual which are deemed to depend largely on intelligence. For purposes of illustration and comparison with the Yerkes scale we shall confine ourselves to those tests which have been tried out, particularly those which are used in the Binet Scale.

In selecting tests and determining upon the degree of exhaustiveness of each, many considerations should be borne in mind, which we need not discuss. It is probable that some of the lengthy tests of the Binet Scale, such as the fables, code, and vocabulary tests should be either shortened or replaced by others, while some of the short ones, such as the dissected sentence test, could be made to afford a greater variety of degrees of performance. It is probable also that a number of new tests could be added to the Binet list to advantage. For the sake of illustration let us assume that we shall find it advisable to include in our series of tests those in Table II.

TABLE II

Possible List of Tests Used in the Series

- | | |
|---------------------------|----------------------------|
| 1. Vocabulary | 10. Memory for ideas |
| 2. Completion | 11. Memory for designs |
| 3. Opposites | 12. Dissected sentences |
| 4. Similarities | 13. Resourcefulness |
| 5. Analogies | 14. Fables or proverbs |
| 6. Logical reasoning | 15. Picture interpretation |
| 7. Arithmetical reasoning | 16. Formboard |
| 8. Memory for digits | 17. Associations |
| 9. Memory for sentences | 18. Sense discrimination |

CONSIDERATIONS REGARDING THE COMBINING OF THE RESULTS OF THE TESTS

Our next task is to combine the measures of ability by the various tests so as to get the best measure of intelligence. This cannot be done, of course, by merely adding together or averaging the scores of the several tests. These must be reduced to a common basis first. One method which might be used would be to equate the averages to the standard or median deviations of the distributions of scores made in the several tests by the same group of individuals. This method would be unsafe, however, until such time as the elements of the several tests

have been very carefully graduated in difficulty so that for any given test the increments of difficulty between the elements are very nearly equal, thus guaranteeing comparability of the distributions of scores in the several tests.

The method advised is, therefore, that the common basis to which to reduce all test scores is the absolute scale of ability. That is, we should find the absolute grade which should be assigned to each degree of performance in each test series. Thus, any degree of performance achieved by 50% of adults would be considered as grade 100 in that test and would be equal to grade 100 in every other test. Degrees of performance in the several tests achieved by 75% of adults would similarly be considered as of grade 90 and therefore equal, etc.

It would be necessary, no doubt, to supplement this method in the cases of the lower degrees of performance by other means since very large percentages of adults would be untrustworthy. Degrees of performance below 80, say, might be equated to one another by finding their relation to an age scale, that is, by finding the degree of performance in each test which may be achieved by 50% of the children of the various ages; or rather, perhaps, to find the age at which just 50% of children could achieve each of the designated degrees of performance in each test. A method which could be employed for this purpose is explained by the writer elsewhere.⁷

Another method, which would probably be more suitable in cases where there are a considerable number of degrees of performance in a single test, would be to find the curve of relation or "*regression curve*"⁸ between age and the several degrees of performance, letting ages be the abscissas and finding first the median degrees of performance for each division of the age scale as a basis for drawing the curve. From this curve then, the precise age could be found for which each degree of performance was most probably standard. In this way a series of scales (virtually diminutive Binet Scales) could be made, each complete in itself in a small way.

The question may now arise in the mind of the reader why we do not rest with finding the mental age of the child in each test and determining a representative value of these mental ages.

⁷ *Some Logical Aspects of the Binet Scale*, Psychological Review, March and May, 1916.

⁸ See WM. BROWN, *The Essentials of Mental Measurement*, 1911.

The reasons for converting the test score from mental ages into absolute grades of intelligence or of the specific ability, are as follows: First, it is not correct to average the scores as mental ages in all cases since the absolute average of a mental level of 16 years and one of 12 years is not one of 14 years but is less than 14 years, that is, 16-year ability is, absolutely considered, closer to 14-year ability than is 12-year ability. A second reason is that we cannot express degrees of ability above normal adult ability in terms of any mental age; and a third reason is that the scores of the different tests should be weighted to take into account different degrees of efficiency of different tests.

After having found the curve of relation between age and degree of performance in each of the tests, then through the medium of the age scale the correspondence of degrees of performance in each test scale can be found with those of every other. It would then remain to transmute measures of the various degrees of performance in each test from age values into units of the absolute scale. Various methods could be suggested for accomplishing this. One would be to find the percentage of adults which pass that degree of performance in each test corresponding to ten-year ability, to find the absolute value corresponding to the median of these percentages and to consider this as being the absolute value which corresponded to ten-year ability, etc. A more refined method might be used which involved a comparison of the variabilities of the distributions of grades of intelligence of the children of the different ages for the purpose of determining the curve of growth of intelligence. Thus we might find the correspondence of the age scale determined as suggested above, to be that shown in Table III.

TABLE III

3	4	5	6	7	8	9	10	11	12	13	14	15	16	18
20	27	34	41	48	55	62	68	75	81	87	92	95	98	100

We have assumed that the distributions of absolute grades of intelligence attained by the children of each age were normal distributions having variabilities proportional to the values of their central tendencies (this will be the case if our hypothesis regarding the growth of general intelligence is true), and have considered it possible to so graduate our absolute scale that the quotient obtained by dividing the actual absolute grade of intelligence of any child by the absolute grade which is normal for

children of his age would give us an absolute intelligence quotient (A I Q) which is constant for a given child throughout all ages and may be taken as the "coefficient of brightness" of the child and as a measure of the degree of brightness which he will have also when an adult. By means of this "absolute intelligence quotient" obtained for any child we may predict the probable ultimate absolute grade of intelligence which he will reach and thereby predict the probable maximum intellectual attainments which he will achieve.

WEIGHTING THE SCORES ACCORDING TO VALUE AS MEASURES OF INTELLIGENCE

If we merely found the average or median level of ability attained in a series of tests by a given child, we would be assuming that all tests were of equal significance as measures of intelligence. As has been stated, however, certain tests are much more significant than others. This may be due to finer scale gradations or to more time devoted to giving the test or to the fact that the ability tested is less dependent upon factors other than those which we consider as constituting intelligence. The tests should be weighted, therefore, according to their significance as measures of intelligence.

There are several ways, of course, in which this could be done. One would be to make use of a criterion of intelligence apart from the tests, to which they would be compared. Thus we might get as reliable an estimate as possible of the intelligences of pupils by their teachers and find the manner of combining the results of the tests which would give the best approximation to that estimate. The method generally employed in such a case is that of partial correlation and the regression equation.⁹

Another and perhaps better method of weighting the test results could be employed in which no external criterion was used. Thus McCall¹⁰ finds the amount of correlation between each test and a measure obtained by combining the measures of all the tests when these were weighted by "guess." It may be shown, however, that a very good approximation of the relative degrees

⁹ See G. UDNY YULE, *An Introduction to the Theory of Statistics*, Chapter 12, or TRUMAN L. KELLEY, *Bulletin of the University of Texas*, 1916, No. 37.

¹⁰ W. A. MCCALL, *Correlations of Some Psychological and Educational Measurements with Special Attention to the Measurement of Mental Ability*. School and Society, January 6, 1917.

in which each test measures a factor common to all the abilities tested may be found by a consideration of the amounts of inter-correlation between the tests taken singly. Proof of this may be derived from the formula for partial correlation.

Assuming that we have satisfactorily determined the weightings to be given each test result, an illustration will be given of the determination of the weighted average of the levels of attainment in the various tests, supposing that an abbreviated series of tests is being used consisting of the tests named in Table V. Let us assume that a child attained a degree of performance in each test which would yield the grade scores designated in column 2, and let us suppose the respective weights of the tests as determined in an approved manner are as shown in column 3. (These are made small numbers for convenience of illustration.)

TABLE V

1	2	3	4	5	6
Tests	Test Grade Scores	Weights	Weighted Scores	Altered Weights	"Points"
1. Digits.....	77	×	2 = 154	1.0	77
2. Similarities.....	83	×	3 = 249	1.5	125
3. Analogies.....	80	×	3 = 240	1.5	120
4. Completion.....	88	×	4 = 352	2.0	176
5. Discrimination...	65	×	1 = 65	0.5	32
6. Sentences.....	72	×	2 = 144	1.0	72
7. Vocabulary.....	95	×	5 = 475	2.5	238
Totals.....	7)560	20	20)1679		840
Average	80	Weighted average	84		

Now, of course, the sum of the weights may be made equal to any number so long as the proportions are kept the same. They may be altered, therefore, so that their sum equals 10 (using decimal fractions). Moreover, the values of the grade scores for each test may be multiplied by the proper weight thus found and a new table made for each test in which the weighted score in "points" can be read directly, opposite the degree of performance attained. Thus for the sentence test, the correspondence of the degrees of performance (number of sentences repeated) and the absolute grade of ability reached (measured on the absolute scale) and the number of "points" (weighted absolute grade) might be as shown in Table VI.

According to this scheme, the weighted average of the absolute scores of a person achieving median adult performance in

each test would be 1000 "points." That is, 1000 points equals a score of 100 on the absolute scale and, as may be shown, all other scores in points would be just 10 times the corresponding scores on the absolute scale. The latter might now be discarded having served its purpose as the basis for the construction of a "point scale" consisting of weighted scores corresponding to the degrees of performance in each test.

THE CHART

In the Chart we have this Point Scale in the center with 1000 points as median adult intelligence. Values of the grade may be considered as $\frac{1}{10}$ of each number of points. On the left are curves postulating the growth of absolute intelligence. On the right are scales of degrees of performance in nine tests assumed to constitute an abridged series with their corresponding numbers of points.

TABLE VI

Hypothetical Corresponding Scales for a Sentence Test

Number of sentences.....	1	2	3	4	5	6	7	8	9	10	etc.
Absolute grade of ability required.....	20	22	25	30	39	52	65	78	89	100	etc.
Points (Weight 2/6.7).....	6	7	8	10	13	18	22	26	30	33	etc.

Thus we see that to find the number of points designating the absolute degree of general intelligence of any individual, it is necessary merely to find the degree of performance which he can achieve in each test, note the number of points in the chart corresponding to this degree of performance, find the sum of those numbers of points for all the tests and this sum will be the "point-score" which denotes the absolute degree of intelligence of the individual in the determination of which due consideration has been given to the different degrees of efficiency (reliability and correlation with intelligence) of the various tests and which point scores are expressed in units which are equal according to the theory of normal distribution of grades of adult intelligence.

From this "point-score" which may be used to denote the absolute degree of general intelligence and the age of an individual, we may determine upon which curve of growth he is progressing, so to speak. Thus a 12-year-old with 880 points is progressing on the "75% curve" showing that he exceeds 75%

THE CHART FOR A Scale of Absolute Degrees of Intelligence

Hypothetical curves of growth of absolute degrees of intelligence.

Percentages exceeded

Ages.

POINT
SCALE

Hypothetical test scores and corresponding points.

Age Scale	No. Words Vocabulary (wt.5) Points	No. Words Completion (wt.5) Points	Number Opposites (wt.4) Points	Number Reasoning (wt.4) Points	Number Analogies (wt.3) Points	Number Figures (wt.3) Points	Syllables Sentences (wt.3) Points	No. Count Designs (wt.2) Points	No. Words Association (wt.1) Points
3-	5 33	10 33	2 29	2 28	2 21	3 20	6 20	10 14	18 7
4-	8 50	20 46	5 39	3 33	4 26	4 27	12 27	20 19	20 10
5-		25 54	10 44	5 44	6 35	4 34	14 36	30 23	
6-	10 67	35 70	15 53	6 52	7 39	4 40		40 27	23 13
7-	15 82	40 80	20 59	7 56	8 43	4 40	16 45	50 31	30 17
8-	20 90	45 88	30 72	9 70	10 53	5 48	18 57	55 35	
9-	25 102	50 96	35 79	10 78	11 58	5 60		60 40	37 20
10-	30 113	60 118	45 94	11 88	12 64	6 68	20 68	65 47	45 23
11-	35 125			12 100	13 72	6 77	22 75	70 53	55 27
12-	40 136	65 133	50 105		14 83	6 84	24 84		
13-	45 143		55 113	13 110				75 60	70 30
14-	50 152	70 148		14 119		7 91	26 92		
15-	55 157		60 125	15 126	15 93	7 95		80 65	90 33
16-	60 164	75 163		16 134	16 100	8 103	28 100		
18-	65 167		65 137		17 107	8 107	30 108	86 71	
	70 174	80 174		17 144					125 37
	75 184		75 151		18 115	8 111	32 116	92 76	
	80 192	85 188		18 156		9 119			160 40
	85 200	90 200		19 170	19 125	10 127	34 123	96 81	
	90 208		75 166			11 131	37 130	98 87	200 43
	95 217	95 217		19 170		12 140	37 130	98 87	200 43
	98 225				20 135	11 135	40 136		
	99 233	100 233	80 186	20 186		12 140	50 142	99 93	250 47
	99.5								

of persons in brightness, will attain an ultimate degree of intelligence represented by 1100 points and therefore has a "coefficient of brightness" of $\frac{1100}{1000}$ or 1.10 and may be expected to ultimately achieve the degrees of performance in the tests opposite the 1100 points on the Point Scale. In the finished chart, of course, a much larger number of curves should be drawn, or else these must be supplemented by a table composed of portions similar to Table IB for every fractional year of age.

It is quite possible that in the actual making of a point scale as outlined above, some modifications in the arrangement of tests would be necessary, since certain tests which are excellent for persons above a certain age might be incapable of being used with very young children, such as those who could not read in the case of the completion test. In this case it would be necessary merely to substitute a suitable test in the lower part of the scale, the reliability of which was such that it would be weighted the same. In fact if the reliability of a single test were different for different extremes of the scale it could be divided, and each half could be completed with tests having the proper reliability. Scale arrangement on the Chart is of no consequence in giving the tests.

In postulating the absolute grades of intelligence which corresponded to certain degrees of performance in three of the tests, the vocabulary, digit and sentence tests in the Chart, reference was made to the Stanford Revision of the Binet Scale and the numbers of words of vocabulary, digits repeated on third trial, and syllables in the sentences repeated, were placed opposite the mental age corresponding to the age group in which these degrees were found. Thus since "Repeats 4 digits" was found in age group IV, 4 was placed opposite mental age 4 years.

THE MAKING OF A "BINET POINT SCALE"

Before taking up the specific criticism of the Yerkes-Bridges Point Scale, let us see how the Stanford Revision of the Binet Scale compares with our suggested point scale. For this purpose let us convert it into a point scale as far as possible. For the sake of conciseness let us denote the various tests by their numbers and catch names referring the reader to the test blank for a more complete knowledge of the tests.

TABLE VII
A Binet Point Scale

Point Scale	Mental Age	Points	List 1	Points	List 2	Points	List 3
12	III	2	(1) Body	2	(3) Pictures	2	(2) Objects
24	IV	2	(1) Lines	2	(2) Forms	2	(3) Pennies
36	V	2	(1) Weights	2	(4) Definition	2	(3) Comparison
48	VI	2	(1) Right and Left	2	(2) Pictures	2	(3) Pennies
60	VII	2	(1) Fingers	2	(2) Pictures	2	(4) Knot
72	VIII	2	(6) Vocabulary 20	2	(5) Definition	2	(4) Similarities
84	IX	2	(2) Weights	2	(1) Date	2	(5) Words
96	X	2	(1) Vocabulary 30	2	(3) Designs	2	(2) Absurdities
120	XII	4	(1) Vocabulary 40	4	(3) Fables	4	(8) Similarities
144	XIV	4	(1) Vocabulary 50	4	(2) Induction	4	(5) Arithmetic
168	XVI	4	(1) Vocabulary 65	4	(3) Fables	4	(6) Boxes
192	XVIII	4	(1) Vocabulary 75	4	(2) Paper	4	(5) Digits 7 back.

A Binet Point Scale—Continued

Point Scale	Mental Age	Points	List 4	Points	List 5	Points	List 6
12	III	2	(7) Digits 3	2	(5) Name	2	(6) Syllables 6-7
24	IV	2	(6) Digits 4	2	(5) Comprehen. 1	2	(7) Syllables 12-13
36	V	2	(6) Commissions	2	(5) Patience	2	(2) Colors
48	VI	2	(5) Coins	2	(4) Comprehen. 2	2	(6) Syllables 16-18
60	VII	2	(3) Digits 5	2	(5) Differences	2	(7) Days
72	VIII	2	(2) Counts	2	(3) Comprehen. 3	2	(1) Ball and Field
84	IX	2	(4) Digits 4 back.	2	(6) Rhymes	2	(7) Months
96	X	2	(7) Digits 6	2	(5) Comprehen. 4	2	(8) Syllables 20-22
120	XII	4	(6) Digits 5 back.	4	(2) Definition	4	(4) Ball and Field
144	XIV	4	(7) Digits 7	4	(3) Differences	4	(6) Clock
168	XVI	4	(5) Digits 6 back.	4	(2) Differences	4	(7) Syllables 28
192	XVIII	4	(3) Digits 8	4	(6) Ingenuity	4	(4) Memory

Suppose we consider the first test scale as made up of III, (1) Body; IV, (1) Lines; V, (1) Weights, etc., as shown in Table VII. We could in this way make up six "lists" of tests, each list corresponding to a "test" in the Chart and each test corresponding to a degree of performance in a test in the Chart.

Different degrees of the same ability are recognized in the Binet Scale in the following: Digits, Syllables, Definition, Comprehension, Pennies, Pictures, Vocabulary, Similarities, Weights, Time orientation, Designs (Forms), Ball and Field, Fables, and Differences. So far as possible, therefore, those of a kind have been placed in the same lists. Thus we see that List 4 is almost entirely made up of degrees of memory for digits.

In so far as any list is composed of tests representing different degrees of the same ability, such as vocabulary or memory for digits, it may be said that the ability to achieve a certain degree of performance, such as defining 30 words, or repeating six digits, presupposes possession of the ability to achieve all lesser degrees of performance in the same list and none of the greater degrees. This cannot be said, however, of any of the lists where the abilities are different, since a child might conceivably succeed in the tests III, IV, V, VIII and IX of List 2 and fail in VI, VII, as well as those above IX. It is perhaps fairly safe to say that his "average ability" in the tests of a single list is approximately represented by the age corresponding to his point-score in the list, even though the tests passed be not in consecutive order.

To use the Binet Point Scale, the tests constituting the regular Binet Scale would be given exactly as is usual. One should then note how many tests in each list were passed and find the sum of the points corresponding to each test passed, as indicated in the column headed Points. This sum would constitute the "point-score." The correspondence between the Point Scale and the Mental Age Scale at the left of the table has been arranged on the assumption that the passing of six tests (12 points) indicates mental age III, that the passing of twelve tests (24 points) indicates mental age IV, etc. A point score of 66 points ($60 + 6$) indicates a mental age of seven years (VII) and six months, a point score of 164 points ($144 + 12 + 8$) indicates a mental age of fifteen years and eight months, etc. Each point corresponds to an increment of one month in mental age. (Mental ages XVI and XVIII are fictitious.)

SPECIFIC CRITICISM OF THE YERKES-BRIDGES POINT SCALE

It may be seen, therefore, that to convert the present Binet Scale into a point scale is merely to reorganize it on paper. As for the administering of the tests, as above mentioned, this would be done in exactly the same manner for our Binet Point Scale as for the Binet Scale. Even the scoring would be done in the same way. The only difference is in the manner of expressing the result—whether the degree of maturity of the child be spoken of in terms of “mental age” or “points.” As a matter of fact the upper mental ages are merely arbitrary designations anyway, as has been said. In other words, we may say that *the present Binet Scale is already a point scale*, for all the purposes for which Yerkes’ and Bridges’ alteration¹¹ of the Binet Scale could be used. If Yerkes and Bridges had let each month of mental age by the present Binet Scale be called a “point” or given one “point” for passing each test, they would have had a series of “point scores” which would have “lent themselves readily to statistical work,” as they say, including the use of different norms for different classes if desired, the comparison of mental ability with physiological maturity, etc. At the same time, the Binet scores thus converted would be more valid for the following reason.

Obviously, if a “point” has any meaning, it must stand for an increment of intelligence or intellectual maturity having the same value as that of every other “point,” as nearly as possible. In the Binet Point Scale one “point” indicates one month’s normal growth in intellectual maturity. In so far as months of normal growth are equal, the values of “points” in the Binet Point Scale are equal and therefore statistically valid. Those points coming near together in any part of the scale may be assumed to be practically equal (if the tests are properly standardized), as rate of growth probably changes gradually. In so far as the values of the points in the two ends of the scale are not equal (on account of slowing down in rate of growth) this error can only be corrected by some such method as we have outlined for making a point scale, in which “points” refer to equal absolute increments of intelligence.

¹¹ The “Point Scale” is practically the Binet Scale remodeled.

In Yerkes' and Bridges' alteration of the Binet Scale, however, even the time basis of equality in point values has been lost by a seemingly complete disregard for the necessity of having such values equal. One has but to examine Yerkes' and Bridges' alteration to note the absence of any apparent system in the assigning of points to increments of mental ability. For example, the abilities required to repeat series 3, 4, 5, 6, and 7 digits are assigned 1, 2, 3, 4, and 5 points, respectively. Now the assumption implicit in this arrangement, taken by itself, is that the increments of mental growth from each such ability to the next are all equal. Not only is no basis presented upon which this arrangement was made, but the indications of data strongly suggest that such is not the case, since the amounts of growth necessary to gain these four increments of ability, 3 to 4, 4 to 5, 5 to 6, and 6 to 7, digits are found to be approximately 1, 3, 3, and 4 years respectively, as indicated by the placement of these tests in the Binet Scale.

Similarly, one point is given in Yerkes' and Bridges' alteration for defining in terms of use each of the following words: chair, horse, fork, baby. Obviously, the difference between the ability to define one of these and the ability to define four of them in terms of use only, is not to be compared with the difference between ability to repeat four digits and the ability to repeat seven digits, though these differences are represented in both cases by increments of 3 points. We believe that these illustrations are sufficient to show that in altering the Binet Scale to make a point scale, Yerkes and Bridges have not only gained nothing over the present Binet Scale, since it is itself already a point scale for those who wish to say "points" instead of "months," but they have materially detracted from its value by a disarrangement which renders the value of a "point" quite meaningless. Such improvements as (1) the expressing of the degrees of intelligence in absolute units so that the value of one point is equal to the value of every other point and so that a given degree of brightness is expressed by the same coefficient at all ages, (2) the defining of the degrees of intelligence above that normal for adults in terms of the percentages of adults possessing these degrees, and (3) the weighting of the results according to the efficiency of the tests, are not even suggested in Yerkes' and Bridges' alteration of the Binet Scale.

Since the above was written, there has appeared in this JOURNAL an article¹² in which the defects of the Yerkes-Bridges arrangement of the Binet Scale are even more clearly shown than can be done by a consideration of the scale construction.

On page 604 of that article, the writers note the extraordinary fact that "During the fourth year of life, intellectual ability (always understood as measured by the point scale) increases more than fifty per cent.; during the fifth year of life, by scarcely more than thirty per cent.; during the seventh year, by approximately fifteen per cent." This shows the kind of results that may be gotten if one point is given to each of too many small increments of ability in the easy part of the scale, as suggested above in the case of defining words. It also shows what is deemed an altogether unwarranted confidence on the part of the writers in the power of numbers of arbitrarily assigned points to "indicate *directly* the rate, or annual increments of intellectual growth," (p. 603, *italics mine*) whereas the appearance of such questionable results should have immediately suggested to the writers the probability of an erroneous construction of the scale.

The obvious aim of intelligence measurement applied to children is to get a measure of the brightness of one child which is *comparable* with measures of brightness of other children of different ages. Presumably therefore, a measure of brightness which is valid, must stand for the *same degree of brightness* at all ages, which means that approximately the *same percentages* of children of the different ages should obtain any given measure of brightness.

Let us see how well this condition is fulfilled in the Yerkes-Bridges arrangement. In Table III in the above mentioned article a "coefficient" of 1.20 or more is attained by percentages of children of ages 4-5, 6-7, 8-9, 10-11, 12-13, 14-15, 16-17, 18-on, respectively, as follows: 34.5%, 33.0%, 15.8%, 13.7%, 5.5%, 6.5%, 0%, 0% (total number of individuals in the "normal group" upon which the measurements were taken = 1282). Certainly these "coefficients of intelligence" do not represent the *same degree of brightness* for the different ages. Obviously, therefore, they are not *comparable* with one another. Can they, therefore, be said to measure brightness or "intelligence" at all?

¹² ROBERT M. YERKES AND LOUISE WOOD. *Methods of Expressing Results of Measurement of Intelligence: Coefficient of Intelligence*. December, 1916, 593-606.

One can easily imagine a thoughtful investigator obtaining this amount of irregularity in what he hoped would be a valid measure of brightness, but it is inconceivable that in the face of such evidence of failure, one should be led into making the statement (p. 598) that "extraordinary intellectual ability is fairly common up to eight years, and then becomes very uncommon."

PRACTICE AND TRANSFERENCE IN NORMAL AND FEEBLE-MINDED CHILDREN

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PART II. TRANSFERENCE

The results obtained on the thirteen days' practice in sorting geometrical forms, by both the normal and feeble-minded practice groups, have already been given.¹ These results, it will be remembered, showed that the feeble-minded group, of average chronological age fourteen and average mental age nine, improved the same with practice as the normal group of average mental age nine. It remains to present the data on the transference of this practice effect, as seen in the end tests.

The end tests, given to all four groups, namely, normal practice and control groups and feeble-minded practice and control groups, were four in number. All four of the end tests were given on the same day, but given twice, so that two days were devoted to them at the beginning and at the end of the work with each group. They consisted of the following: sorting five lengths of sticks into five boxes of corresponding length; sorting colored pegs; a letter cancellation test; and a geometrical form cancellation test.

In the case of all the tests, the instructions were for speed only. As instructions for both speed and accuracy are inevitably ambiguous, nothing was said about accuracy. The children were told to see *how many* they could sort or cancel. The instructions were repeated practically in full each time the tests were given, and the children urged each time to do their very best. With these instructions, the proper method of scoring is the total number of elements correctly sorted or cancelled, and it is this number which has been taken in all the tests as the score. At the same time, the number of errors was recorded. Since, however, the errors were so infrequent (except perhaps in the stick sorting test), and, in view of the instructions, so unimportant, only the average error made by each group, each day, in each test, will be found given in the tables below. Space will not be taken to show the errors made by each child individually.

¹ Part I, this JOURNAL, Vol. 8, February, 1916, p. 85.

The end tests may be described more in detail as follows:

Stick sorting test.—This test consisted in sorting sticks of five different lengths, namely, 1", 2", 3", 4" and 5". There were 40 of each length. These were shaken up in a large box, 6" x 6" x 1½", and then sorted into small boxes. The small boxes had lengths just greater than those of the sticks. Each stick had to be sorted into the shortest box into which it would go. The sorting had to be done with one hand, one stick at a time. As the test seemed a rather hard one to understand, 2 mins. practice was given each time before the counted test. During this practice, any child picking up more than one stick at a time or putting any of the sticks into too long a box, was corrected. The time allowed for the counted test was 4 mins.

Peg sorting test.—This test was similar to the above, except that beaded pegs of five different colors (Bradley's Kindergarten Material) were used in place of sticks. Pegs of the same color had to be put into the same small box, but any color might be placed in any box. The number of pegs used was 150, 30 of each color. The time allowed was 3 mins.

Letter cancellation test.—Consisted in cancelling every *K* and *F* in a cancellation blank differing only in minor details from those ordinarily in use. The blank had 20 lines of letters with 56 letters in each row. The sheets were turned face down on each desk before the test began, and instructions given on how to hold the pencil and how to turn over the sheet at the signal to start. To show the children how to cancel, a line of letters was written on the black-board and the *K*'s and *F*'s cancelled. The letters were erased from the board before starting the test. Instructions were given to pass from left to right along each line, without skipping a line, the same as would be done in reading. The time allowed was 3 mins.

Geometrical form cancellation test.—Consisted in cancelling all the crosses and squares in a specially prepared blank on which were printed the same five forms as used in the form sorting practice test. The blank was the same size as the Woodworth-Wells substitution test blank, after which it was patterned, but contained four times as many figures, *i. e.*, 400 instead of 100. Instructions were given much as in the letter cancellation test. The time allowed was 2 mins.

TABLE IV

Initial Results on the End Tests with the Control Groups

	1st Day				2d Day				Average			
Group	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms
Normal												
1	88	113	50	56	111	102	75	78	100	108	63	67
2	73	100	80	71	111	96	101	77	92	98	91	74
3	67	100	79	78	92	95	99	84	80	98	89	81
4	123	136	87	61	131	132	120	89	127	134	104	75
5	65	79	68	71	80	74	92	83	73	77	80	77
6	83	89	82	67	89	87	92	80	86	88	87	74
7	98	93	74	64	109	118	96	70	104	106	85	67
8	85	94	65	82	99	85	83	95	92	90	74	89
9	66	99	62	50	77	97	95	74	72	98	79	62
10	81	84	70	60	78	86	87	67	80	85	79	64
11	97	126	86	68	123	129	119	94	110	128	103	81
Av.	84	101	73	67	100	100	96	82	92	101	85	74
M. V.	13	13	9	8	16	15	10	6	13	15	9	6
Av. Er.	5.0	0.4	0.4	0.2	5.0	0.0	0.0	0.0	5.0	0.2	0.2	0.1
F. M.												
1	92	96	68	48	84	107	100	87	88	102	84	68
2	99	107	81	72	99	126	110	88	99	117	96	80
3	91	68	76	81	105	116	117	89	98	92	97	85
4	70	119	93	66	96	120	100	79	83	120	97	73
5	79	120	65	49	99	107	81	85	89	114	73	67
6	133	105	88	89	131	104	109	92	132	105	99	91
7	92	117	88	87	88	96	123	95	90	107	106	91
8	125	118	55	52	131	125	70	80	128	122	63	66
9	76	66	64	57	85	80	71	73	81	73	68	65
10	51	87	83	73	62	108	95	81	57	98	89	77
11	82	120	102	65	70	167	109	89	76	144	106	77
12	53	58	61	54	81	87	71	63	67	73	66	59
13	65	83	35	43	80	65	82	84	73	74	59	64
14	106	120	59	57	104	109	73	75	105	115	66	66
15	77	110	91	74	95	94	112	97	86	102	102	86
16	113	119	79	60	87	113	103	84	100	116	91	72
17	86	121	70	52	97	95	81	61	92	108	76	57
Av.	88	102	74	64	94	107	95	83	91	105	85	73
M. V.	18	19	13	12	13	15	16	8	14	14	14	8
Av. Er.	8.6	0.1	0.1	0.1	12.4	0.1	0.0	0.1	10.5	0.1	0.1	0.1

In order to interpret the results on transference obtained with the practice groups, it is first necessary to know the results obtained with the control groups, merely from the repetition of the end tests without practice in a related test.

With both the control and practice groups, the end tests were given at the same hour on the same days of the week and with the same number of days between the initial and final testing. With the normal control group, the testing was done one month later than with the normal practice group, the former being tested in December and the latter in November. In the case of the feeble-minded children, the end tests were given to both the practice and control groups at the same time, in two sections, one following the other by one week.

The results with the control groups are given in Tables IV to VII. The headings "Sticks" and "Pegs" refer to the stick sorting and peg sorting tests, while the headings "Letters" and "Forms" refer to the letter cancellation and the form cancellation tests. In Tables IV and V, as well as in the corresponding tables with the practice groups (Tables VIII and IX), the scores given under these headings are those obtained simply by counting the number of elements correctly sorted or cancelled. In the line headed at the left, "Av. Er.," is given the *average* number of elements wrongly sorted or cancelled.

Keeping in mind the equality of improvement shown by the normal and feeble-minded control groups, we may now turn to the results obtained on the end tests with the practice groups. These results are given in four tables, VIII to XI, which correspond with the four tables, IV to VII, on the control groups. As in the case of the control groups, the variability within the groups is great and yet the average initial ability of the two groups is very nearly equal in all the tests. Further, the initial average ability of the two practice groups very nearly coincides with that of the two control groups, as a comparison of Table VII with Table XI will show.

TABLE V

Final Results on the End Tests with the Control Groups

Group	1st Day				2d Day				Average			
	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms
Normal												
1	103	104	66	75	113	108	71	88	108	106	69	82
2	97	102	104	98	78	84	109	131	88	91	107	115
3	103	111	112	96	124	115	141	110	114	113	127	103
4	166	143	134	103	164	144	151	118	165	144	143	111
5	90	73	71	70	93	88	64	108	92	81	68	89
6	106	101	86	79	112	109	98	80	109	105	92	80
7	106	111	101	82	103	122	103	88	105	117	102	85
8	107	98	84	111	108	92	93	104	108	95	89	108
9	96	90	102	88	96	96	111	97	96	93	107	93
10	86	81	87	56	85	111	94	64	86	96	91	60
11	148	138	143	105	151	140	148	113	150	139	146	109
Av.	110	105	99	88	113	110	108	100	111	107	104	94
M. V.	18	15	17	14	20	15	22	15	17	15	20	14
Av. Er.	4.1	0.0	0.3	0.3	5.4	0.0	0.5	0.2	4.8	0.0	0.4	0.3
F. M.												
1	101	106	92	86	121	104	101	105	111	105	97	96
2	112	97	110	97	119	111	125	106	116	104	118	102
3	127	110	104	83	131	99	129	105	129	105	117	94
4	78	104	92	82	88	128	110	96	83	116	101	89
5	106	93	92	64	96	102	84	83	101	98	88	74
6	130	122	101	105	135	113	114	101	133	118	108	103
7	110	122	125	101	128	109	166	128	119	116	146	115
8	129	140	110	80	130	137	121	97	130	139	116	89
9	97	96	83	79	100	79	96	103	99	88	90	91
10	72	128	110	93	86	124	123	94	79	126	117	94
11	75	155	132	123	138	143	134	142	107	149	133	133
12	73	87	87	70	76	98	81	74	75	93	84	72
13	82	86	68	67	81	74	74	76	82	80	71	72
14	123	102	81	97	132	117	104	95	128	110	93	96
15	102	96	122	102	93	99	135	108	98	98	129	106
16	109	111	107	79	125	123	111	73	117	117	109	76
17	112	132	86	65	103	125	101	86	108	129	94	76
Av.	102	111	100	87	111	110	112	98	106	111	106	93
M. V.	16	16	14	14	18	14	17	14	15	14	16	12
Av. Er.	9.2	0.0	0.3	0.1	7.8	0.4	0.5	0.3	8.5	0.2	0.4	0.2

It will be seen from Tables IV and V that the groups were quite heterogeneous,—that the variability within the groups was large. Yet, as Table IV shows, the average initial ability of the normal group very nearly coincides with that of the feeble-minded group. This equality in initial performance of the two groups, along with considerable variation among the individual members, is due to the manner of selecting the groups. The equality between the two groups persists, on the whole, through

the final trials. A comparison of Table V with Table IV will show that a considerable degree of improvement occurred between the first and the fourth, or last, trial. This improvement is very nearly the same, in each of the tests, for both groups. The results on the control groups, then, merely go to confirm those already reported on the practice test by the practice groups. In both cases, while there is marked individual variation, it is impossible to establish any significant difference in improvability between the normal and feeble-minded groups.

TABLE VI

Individual Percentages of Improvement in Final Results over Initial Results, Control Groups

Child	Normal				Feeble-Minded			
	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms
1	8	-1.9	9.5	22.4	26.1	2.9	15.5	41.2
2	-4.3	-7.1	17.6	55.4	17.2	-11.1	22.9	27.5
3	42.5	5.1	42.7	27.2	31.6	14.1	20.6	10.6
4	29.9	7.5	37.5	48.0	0.0	-3.3	4.1	21.9
5	12.3	5.2	-15.0	15.6	13.5	-14.0	20.5	10.4
6	26.7	19.3	5.7	8.1	0.8	12.4	9.1	13.2
7	1.0	10.4	20.0	26.9	32.2	8.4	37.7	26.4
8	17.4	5.6	20.3	21.3	1.6	13.9	84.1	34.8
9	33.3	-5.1	35.4	50.0	22.2	20.5	32.4	40.0
10	8.0	12.9	15.2	-6.2	38.6	28.6	31.5	22.1
11	36.4	8.6	41.7	34.6	40.8	3.5	25.5	72.7
12					11.9	27.4	27.3	22.0
13					12.3	8.1	20.3	12.5
14					21.9	-4.3	40.9	45.5
15					14.0	-3.9	26.5	23.3
16					17.0	0.9	19.8	5.6
17					17.4	19.4	23.7	33.3
Av.	19.2	5.5	21.0	27.6	18.8	7.3	27.2	27.2
P. E. Av.	3.0	1.5	3.4	3.6	2.0	2.2	2.8	2.7

In Table VI, is given the percentage of improvement in each test for each child, that is, the difference between his average in the initial two trials and the final two, taken as a percentage of the initial average. It should be noted that the average percentage improvement given at the bottom line of the table is the average of the percentages of improvement shown by the children individually, not the percentage of improvement in the group averages. It is true that there is but little difference between the improvement in the group averages and the averages of

the improvements shown by the children individually. It is the latter, however, which is of most importance, and which, alone, enables one to ascertain the degree of reliability or unreliability of any general conclusions concerning the children as groups. The individual percentages of each group show great variation, but the averages of these individual percentages are strikingly similar for the two groups.

TABLE VII
Summary of Data on Control Groups

		Sticks		Pegs		Letters		Forms	
		Normal	F. M.	Normal	F. M.	Normal	F. M.	Normal	F. M.
Initial trials	1st day	84	88	101	102	73	74	67	64
	2d day	100	94	100	107	96	95	82	83
	Av.	92	91	101	105	85	85	74	73
Final trials	1st day	100	102	105	111	99	100	88	87
	2d day	113	111	110	110	108	112	100	98
	Av.	111	106	107	111	104	106	94	93
Av. % Gain		19.2	18.8	5.5	7.3	21.0	27.2	27.6	27.2
P. E. Av.		3.0	2.0	1.5	2.2	3.4	2.8	3.6	2.7
Diff. in % Gain		+1.4		-1.8		-6.2		+0.4	
P. E. of the Diff.		3.6		2.7		3.4		4.5	

The summary given in Table VII shows that in only one case, that of the letter cancellation test, is the difference between the two groups in the average percentage of improvement greater than the P. E. of the difference. Even in the letter cancellation test, the percentage of improvement for the feeble-minded is only 1.9 times the P. E. of the difference greater than for the normal group. In order that a difference between two averages may be safely accepted as significant, the difference must exceed four times the probable error of the difference. It may be said, then, that the results on the control groups have utterly failed to show any difference between the normal and the feeble-minded in the degree of improvement due to the repetition of the tests. There are great individual differences in improvability within each group, but no difference of any significance between the two groups.

TABLE VIII

Initial Results on the End Tests with the Practice Groups

Group	1st Day				2d Day				Average			
	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms
Normal												
1	140	92	70	55	129	136	119	95	135	114	95	75
2	72	110	73	56	99	126	104	65	86	118	89	61
3	47	104	64	66	113	141	76	69	80	123	70	68
4	88	101	77	72	107	112	120	89	98	107	99	81
5	104	90	63	63	94	114	68	74	99	102	66	69
6	105	68	63	94	125	112	81	113	115	90	72	104
7	87	98	49	49	100	116	70	53	94	107	60	51
8	77	91	77	72	109	121	93	88	93	106	85	80
9	71	77	54	42	77	78	63	46	74	78	59	44
10	87	100	87	65	134	110	111	90	111	105	99	78
11	84	73	54	52	97	80	68	85	91	77	61	69
12	63	89	71	67	78	85	83	80	71	87	77	74
13	73	102	86	64	67	104	96	85	70	103	91	75
14	78	84	74	67	102	109	101	76	90	97	88	72
15	102	106	89	70	122	91	102	88	112	99	96	79
16	69	92	77	49	86	106	87	71	78	99	82	60
Av.	84	94	70	63	102	109	90	79	94	101	81	71
M. V.	15	10	10	10	15	14	17	13	14	10	12	10
Av. Er.	1.9	0.4	0.4	0.8	1.9	0.0	0.5	0.0	1.9	0.2	0.5	0.4
F. M.												
1	108	101	76	98	92	87	117	92	100	94	97	95
2	87	88	78	79	91	77	98	92	89	83	88	86
3	95	126	63	63	107	120	72	79	101	123	68	71
4	88	125	75	46	93	107	94	77	91	116	85	62
5	89	119	120	115	109	117	117	113	99	118	119	114
6	45	115	87	65	60	101	121	104	53	108	104	85
7	114	113	87	78	100	93	104	87	107	103	96	83
8	66	113	51	52	91	90	81	92	79	102	66	70
9	99	119	57	62	102	105	93	63	101	112	75	63
10	29	78	37	35	93	114	72	72	61	96	55	54
11	90	86	29	56	109	108	97	77	100	97	63	67
12	102	106	80	77	114	107	96	84	108	107	88	81
13	92	102	68	50	93	90	95	60	93	96	82	55
14	104	120	76	77	128	123	124	93	116	122	100	85
15	77	61	67	52	82	66	87	69	80	64	77	61
16	91	116	51	55	100	80	69	56	96	98	60	56
17	111	117	54	44	87	124	66	53	99	121	60	49
18	119	108	90	85	133	112	123	100	126	110	107	93
19	67	76	41	59	101	82	85	74	84	80	63	67
20	65	81	53	61	106	88	112	85	86	85	83	73
Av.	87	104	67	66	100	100	96	81	93	102	82	74
M. V.	17	16	17	15	11	14	15	13	13	13	14	14
Av. Er.	4.2	0.0	0.1	0.8	3.1	0.9	0.5	0.4	3.7	0.5	0.3	0.6

TABLE IX

Final Results on the End Tests with the Practice Groups

Group	1st Day				2d Day				Average			
	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms
Normal												
1	171	138	145	77	162	160	153	101	167	149	149	89
2	88	144	126	86	114	154	132	108	101	149	129	97
3	104	148	89	87	119	149	103	94	112	149	96	91
4	122	129	137	83	133	138	148	112	128	134	143	103
5	121	135	103	100	125	148	119	113	123	142	111	107
6	124	123	115	104	156	122	135	144	140	123	125	124
7	129	103	83	68	139	130	93	97	134	117	88	83
8	115	130	100	82	128	145	109	91	123	138	105	87
9	93	94	75	70	97	107	93	72	95	101	84	71
10	120	146	137	111	146	157	157	124	133	152	147	118
11	112	94	94	93	140	120	103	123	126	107	99	108
12	102	101	114	91	83	117	135	110	93	109	125	101
13	91	91	107	73	116	113	122	91	104	102	115	82
14	150	120	109	95	174	151	113	109	162	136	111	102
15	121	115	138	100	120	136	144	119	121	126	141	110
16	113	128	99	79	133	151	102	94	123	140	101	87
Av.	117	121	111	88	130	137	123	106	124	130	117	98
M. V.	15	20	17	10	18	15	18	13	15	15	18	11
Av. Er.	2.7	0.0	0.5	0.4	3.6	0.0	0.3	0.0	3.2	0.0	0.4	0.2
F. M.	111	126	137	109	104	121	150	109	103	125	144	109
2	99	99	95	93	110	94	102	120	105	97	99	107
3	139	167	98	97	129	153	94	104	134	160	96	101
4	112	134	122	105	118	162	135	121	115	148	129	113
5	119	154	161	145	139	162	167	152	129	158	154	149
6	136	137	110	96	131	148	147	106	134	143	129	101
7	128	156	115	97	131	136	110	117	130	146	113	107
8	107	132	103	96	132	135	137	115	120	134	120	106
9	121	112	83	90	99	121	89	113	110	117	86	102
10	82	81	55	48	87	100	82	57	85	91	69	53
11	129	143	114	83	138	150	113	103	133	147	114	93
12	147	90	107	109	139	104	117	113	143	97	112	111
13	92	111	81	72	104	108	115	86	98	110	98	79
14	113	179	119	103	134	179	137	112	125	179	128	108
15	79	63	92	84	90	77	99	88	80	70	96	86
16	107	127	77	62	105	135	84	66	106	131	81	64
17	121	154	87	72	147	141	92	79	134	148	90	76
18	160	149	143	108	153	150	146	102	157	150	145	105
19	149	168	102	85	154	135	123	105	152	152	113	95
20	108	119	109	76	104	102	114	85	106	111	112	81
Av.	118	130	106	92	122	131	118	103	120	131	111	97
M. V.	17	24	19	15	18	20	20	15	17	23	18	15
Av. Er.	4.8	0.0	0.3	0.5	3.5	0.1	0.2	0.5	4.2	0.1	0.3	0.5

Table X gives the individual percentages of improvement shown by the practice groups in the end tests after practice. It will be noted that here again there is great individual variability. Compared with the enormous individual differences, the differences between the averages for the normal and feeble-minded groups is impressively small.

TABLE X

Individual Percentages of Improvement in Final Results over Initial Results, Practice Groups

Child	Normal				Feeble-Minded			
	Sticks	Pegs	Letters	Forms	Sticks	Pegs	Letters	Forms
1	23.7	30.7	56.7	18.7	3.0	33.0	48.4	14.7
2	17.4	26.3	44.9	59.0	17.9	16.9	12.5	24.4
3	39.6	21.1	37.0	33.8	32.8	30.1	41.2	42.3
4	30.5	25.2	44.4	27.2	26.3	27.6	51.8	82.3
5	24.2	39.2	68.2	55.0	30.1	33.9	29.4	30.7
6	21.7	36.7	73.6	19.2	153.0	32.4	24.0	18.8
7	42.4	9.3	46.6	62.7	21.5	41.7	17.7	28.9
8	32.2	30.2	23.3	8.8	51.8	31.4	81.8	51.4
9	28.4	29.5	42.3	61.5	8.9	4.5	14.7	61.9
10	19.8	44.8	48.4	51.3	39.3	-5.2	25.5	-1.8
11	38.3	39.0	62.2	56.5	33.0	51.5	81.0	38.8
12	31.0	25.3	61.6	36.5	32.4	-9.3	27.3	24.7
13	48.6	-1.0	26.4	9.3	5.4	14.6	19.5	43.6
14	79.8	40.2	26.1	41.7	77.5	46.7	28.0	27.1
15	8.0	27.3	46.8	39.2	0.0	9.4	24.7	41.0
16	57.6	41.4	23.2	45.0	10.4	33.7	35.0	14.3
17					35.4	22.3	50.0	55.1
18					24.6	36.4	35.5	12.9
19					80.8	90.0	79.4	41.8
20					23.1	30.6	34.9	11.0
Av.	34.0	29.1	45.7	39.1	35.4	28.6	38.1	33.2
P. E. Av.	2.8	2.0	2.6	3.0	5.0	3.2	3.1	2.9

Now since the work with the control groups showed that improvement due to mere repetition of the tests was the same for both the feeble-minded and normal groups, the percentages of improvement shown by the practice groups may be compared directly, without correction for repetition, to determine which group shows the greater transference.

The average percentage of improvement for both the feeble-minded and normal groups, for each test, as well as the difference in these percentages is given in the lower part of Table XI. In the bottom line of this table is given the probable error of the

TABLE XI

Summary of Data on End Tests with Practice Groups

		Sticks		Pegs		Letters		Forms	
		Normal	F. M.	Normal	F. M.	Normal	F. M.	Normal	F. M.
Initial trials	1st day	84	87	194	104	70	67	63	66
	2d day	102	100	109	100	90	96	79	81
	Av.	94	93	101	102	81	82	71	74
Final trials	1st day	117	118	121	130	111	106	88	92
	2d day	130	122	137	131	123	118	106	103
	Av.	124	120	130	131	117	111	98	97
Av. % Gain		34.0	35.4	29.1	28.6	45.7	38.1	39.1	33.2
P. E. Av.		2.8	5.0	2.0	3.2	2.6	3.1	3.0	2.9
Diff. in % Gain		-1.4		+0.5		+7.6		+5.9	
P. E. of the Diff.		5.7		3.8		4.0		4.2	

difference, so that we may express the difference found in terms of the probable error of these differences. Calling a difference which shows greater improvement for the normal children plus, and one which shows less improvement for the normal children minus, the differences obtained in the percentages of improvement are as follows: Stick sorting test, -0.24 P. E.; peg sorting test, $+0.13$ P. E.; letter cancellation test $+1.9$ P. E.; form cancellation test, $+1.4$ P. E. Remembering the rule that a difference must exceed four times the probable error to be significant, it is evident that in no case is there a difference between the groups which begins to be significant. The differences do not differ in any other way than one might expect, in view of the variability within each group, were there no true differences between the groups.

It should, of course, be noted that the conclusion to be drawn is a negative one. It is that no reliable difference in the degree of improvement or of transference shown by the two groups can be found in the present data. This does not mean, on the other hand, that a reliable equality of the groups has been demonstrated. A demonstration of the latter sort is practically impossible in psychological matters. All we can do is to accumulate more and more data and then if the conclusions continue to be

negative, assume with more and more certainty that, if any true differences exist, they are of negligible importance.

It should be noted, further, that the unreliability of these differences is determined in a way which is not affected by the absolute size of the averages between which these differences exist. The unreliability of these differences is not affected, therefore, when we decrease the averages of improvement of the practice groups by subtracting those of the control groups. The remainders give the percentages of improvement which may be regarded as due to transference apart from improvement due to mere repetition of the end tests. Since the results on the control groups show substantial equality in the improvement of these groups, and indicate that the found differences between them are due to accidental variation, one may simply subtract the average percentages of improvement of both control groups from those of the practice groups in order to find out how much the improvement of the latter was due to transference. By so doing, we obtain the following average percentages of "pure" transference: stick sorting test, 15.7%; peg sorting test, 22.5%; letter cancellation test, 17.7%; form cancellation test, 8.8%. These percentages are small. There is no evident reason, however, why they are not large enough to permit the demonstration of a difference between the normal and feeble-minded groups, providing this difference were great enough not to be swamped by the individual variability.

We may now consider the general outcome of the present investigation. The feeble-minded children, averaging fourteen chronologically, may be regarded as practically arrested in mental development. Their average mental age five years hence will pretty certainly not increase by more than one year. The normal children, on the other hand, will pretty certainly go on increasing in mental age as fast as in chronological age for some years to come. Yet, so far as the present data go, the feeble-minded children respond to practice as readily as the normal children. General experience has long since demonstrated that feeble-minded children can do pretty much everything that a normal child of the same mental age can do. Indeed, they do some things much better than a normal child of the same age ever does, simply because they remain at a given mental age long enough to obtain the maximal skill compatible with that

mental age. The preceding results go beyond general experience merely in suggesting that the feeble-minded child not only can learn to do the same things that a normal child of the same mental age can do, but that, on the average, he can learn them equally rapidly. This seems plausible enough. If children have the same mental age, does this not mean that they should manifest the same ability; and if so, that they should show not only the same initial ability but the same ability after practice? Now, if this suggested conclusion be true, it means that when a feeble-minded child requires several years to gain one year in mental age, this is not because he is learning more slowly than the normal child. If it is not inferior ability to learn which keeps the feeble-minded child from becoming normal, what is it?

To this question, several answers occur. It may be that the feeble-minded child, though he improves with practice the same as the normal, does not retain his improvement as well. No data bearing on this possibility have here been obtained; but against it, is the fact, that the degree in which the memory of feeble-minded children falls below that of normal children is not commensurate with the degree in which feeble-minded children fall below normal children in general intelligence.²

Again, it might be that the feeble-minded improves with practice in the thing practised as much as the normal child, but that he is less able to benefit from this practice when he turns to somewhat different activities, in short, that he shows a lesser degree of transference. The preceding study throws grave doubt on this supposition. The data obtained, while not proving that the feeble-minded show exactly the same amount of transference as the normal, indicate that the difference, if any really exists, is slight,—far too slight, it would seem, to explain the difference between the rates at which normal and feeble-minded children increase their mental age.

The answer to the question, then, what determines the rate at which a child changes from one mental age to another, so far as the present study suggests one, is negative. It is that this rate of change is *not* due to capacity to improve with practice or to obtain transference effects. It follows, with considerable plausibility, that the determining factor is solely the capacity to grow.

² G. E. JOHNSON. Journ. of Psycho-Asthenics, Vol. II, 1, 1897, pp. 68-69.

In the mind of the writer, then, the present results show, in a striking manner, the distinction between ability to learn and the ability to grow. We are apt to think of these as inseparable. In the normal child, they usually appear so. But the present data indicate that the capacity to improve with practice is no index of the capacity for mental development, that is, of the capacity to change from one mental age to a superior one. This finding is the reverse of the one expected at the beginning of the investigation. Feeble-minded children, having very little capacity for mental development, were yet found to show no reliable difference from normal children in the capacity to improve with practice. It follows, then, as far as the present data go, that *in children of the same mental age, there is little or no correlation between ability to improve with practice and ability to change from one mental age to a higher one, between ability to learn and the ability to grow.* This conclusion, of course, has no bearing on the question as to the value of a practice test as a test of mental age.

In conclusion, it should be emphasized that the present results were obtained from practice continued for only a short time. Now, in practice which is continued sufficiently long, there will be improvement which is not really due to practice, but to growth; and in such practice, no one can doubt that normal children would, in many cases, outstrip feeble-minded of the same mental age. This would occur in all cases of mental work except those, if there are such, in which the maximal performance, with the limit of practice, is as good at the mental age used as at a superior age.

To determine whether there are any such kinds of work, and if so, what they are for each mental age, is one of the most important problems in the psychology of mental development, as well as a very practical problem in the psychology of the feeble-minded. We have a number of "curves of mental growth," but to what extent the rise in these curves is due to increase in mental age and to what extent to practice in identical or allied functions can only be determined by plotting the curves of maximal ability, at the limit of practice, for the different mental ages. For example, the difference between an adult and a nine-year-old child in a simple sorting test is very great at the first trial; but it is very much less at the limit of practice, since the child improves in this test much more than the adult. To what extent

is the same thing true of memory tests, of speed in writing, of lace-making, etc? Certainly growth curves of ability at the limit of practice would look very different from, and make an interesting comparison with, those of initial ability.

SUMMARY

Feeble-minded children, of average mental age, nine, and chronological age, fourteen, were compared with normal children of the same mental age, with regard to practice and the transference of training. As regards practice, it was found that the normal and feeble-minded practice groups showed the same improvement in the test practiced, a form sorting test. Further, the normal and feeble-minded control groups showed the same improvement with repetition of the end tests, four in number. The conclusion is definitely indicated, therefore, that feeble-minded children improve with practice the same as normal children of like mental age.

As regards transference, the results were less definite. In two of the end tests, stick sorting and peg sorting, the average percentage of transference was practically the same for both groups. In the other two end tests, letter cancellation and form cancellation, the normal children showed a slightly, but not reliably, greater average percentage of transference than the feeble-minded. In general, then, no significant difference in the amount of transference was found between the normal and feeble-minded groups.

Since, as regards mental age, the feeble-minded children used are changing but little, while the normal children are changing rapidly, it follows, that the ability to change from one mental age to another is due to something else than the ability to improve with practice or the ability to secure a transference of the effects of practice. Since this something else is presumably the capacity for mental growth, the present data indicate an absence of correlation between the capacity to learn and the capacity to grow mentally. The degree of intelligence (mental age) is a condition of the rate of learning; but the rate of learning does not affect the rate of growth in intelligence.

CONFUSION IN RECALL

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The tendency to confusion in learning has long been a subject of study in psychology, under the titles *inhibition* and *interference*. But the more treacherous tendency to confuse associates, which seem, at least, to have been formed correctly, with the wrong members of a pair of other associates, *i. e.*, confusion in recall, has hardly been considered. With a view to showing the extent of this tendency to confuse in delayed recall what was not confused in immediate recall; or, to show how much confusion tends to increase with time, between the first mastery and recall after considerable time, a few tests and observations have been made.

While teaching history to a group of 36 rural teachers the writer received among other answers, the following: "Monroe Doctrine was the doctrine in which Monroe could remove any one from office who did not have the same view as he did." "Monroe Doctrine—That Kansas and the other states should come in as free and slave states." "The Monroe Doctrine said that a certain number of states should be made out of the Northwest Territory. The boundary line was fixed at 36° 40'. Slavery should exist north of this boundary line." "Monroe Doctrine—Any foreigner deemed injurious to U. S. should be considered an unfriendly act." "Monroe Doctrine—Was the people said that if any body should say anything horse about the President would be considered an unfriendly act or to gain dominion over America should be fined or imprisoned." "British New York Campaign—Braddock was to come down to New York from the North, Rosecrans was to come from the West, and Burgoyne was to come from the South." "William Lloyd Garrison—Sec'y of War under President Wilson." "Secession means to go in order." "Carpet Baggers were people from the North that went South to travel."

The above are striking examples of confusion in recall. No doubt each student once knew the correct answers to the questions asked but meanwhile had gotten all or parts of the answer

confused with that of one or more other questions. It is significant that these teachers had practically all studied from Barnes' History of United States and had been accustomed to employ the rote memory method of studying history.

The materials most readily confused, theoretically, are those least meaningful. Formal Logic, therefore, ought to be rich in offering cases of confusion in recall. From a large collection of confusions gathered during a half year's course in formal logic a few examples, collected at different times are given here: In one written lesson six out of 23 confused the various *figures* one with another; five confused *collective* and *general* terms; and three *concrete* and *abstract*. When asked to convert a given proposition and then to obvert another given proposition 16 out of another group of 28 correctly *obverted* the one they labeled *converted*. Not one made a mistake in the operation *per se*. They had confused entire units. These answers were all given to questions which were asked unexpectedly, several weeks after the material called for had been studied in class.

A more definite test of this problem was made on a group of 50 students six months after they had finished the subject of logic. They were asked five simple questions which the teachers of logic in that school considered the A B C's of the subject. Since these students had been promoted it is fair to assume that the confusions indicated are confusions of delayed recall. Three showed such confusion among *abstract*, *collective*, and *general* terms; eighteen indicated some form of confusion in transposition (conversion, obversion and contraversion). Eleven confused formal *deductive fallacies* with *inductive fallacies*. When asked to indicate the position of the middle term in each of the four *figures* one confused first and fourth, one confused all four with one another, six confused with *moods*, and 13 had from one to four displacements of symbols within the *figures*.

The familiar character-word association tests, *a* and *b*, by Thorndike were given to 40 normal school girls. After *a* was recalled a diversion of five minutes was improvised before the *b* test was given. One and one-half minutes were given for learning and for recall. After one day the subjects were asked unexpectedly to recall again, and a third such recall was made after 3 weeks.

TABLE I
Character-Word Association Test
 40 Subjects

Recall		Percentage of Correct Recalls Properly Associated		
		Test A		Test B
First		89.4		100.
Second	and	87.1	charm	97.1
Third		78.9		84.0
First		88.2		100.
Second	are	79.1	John	87.9
Third		62.5		72.0
First		90.3		100.
Second	sect	95.2	grit	89.5
Third		66.6		100.
First		79.3		97.4
Second	hope	76.5	place	82.2
Third		60.0		90.9
First		88.6		94.7
Second	mess	100.	flag	96.3
Third		84.2		85.2
First		94.7		90.3
Second	rein	93.7	bar	82.3
Third		88.2		87.7
First		84.4		78.8
Second	pick	94.4	bung	78.3
Third		70.0		75.0
First		100.		85.7
Second	four	96.6	nymph	77.4
Third		86.2		56.3
First		100.		96.9
Second	nose	97.3	dent	100.
Third		90.		100.
First		92.6		96.8
Second	meet	84.2	yet	86.4
Third		66.6		84.6

Table I gives the percentage of correct recalls that were properly associated. This is given for each word in both tests for the three successive recalls. It is obvious that a decrease in this percentage indicates an increase of confusion. This means that in delayed recall, there was increased tendency to attach the several words to the wrong character. Therefore the figures show for each word in test *a* and for all but two in test *b*, a pronounced increase in confusion after 3 weeks (third recall). The increase, however, for recall after one day is slight and for some words there is a positive decrease in confusion. Primacy and recency seem to play no part.

A second test purposely designed to confuse was employed. It was given also to study some factors in delayed recall and the value of working against time. Only those results dealing with confusion will be considered here. The records for working against time and for working at leisure are combined into one group. The test follows:*

273	732	372	723
beat	tow	desert	waist
statue	meat	week	pear
dessert	waste	stake	toe
steak	kernel	beet	meet
weak	pair	statute	colonel

The subjects were told that they would be given a slip of paper upon which were four columns of words with a three place number at the head of each column, that on the signal "go" they would study the material so that they could reproduce the words under their appropriate number, but that the words did not have to be learned in order.

In recording the data the order of a number if not in the correct column-position was counted correct if more than half the words which appeared beneath were properly associated with the number. Likewise if more than two of the words of a column were the same as the original they were counted correct, even if the proper number appeared elsewhere, or was absent, or even if no other number headed the column. In case one of these exceptions occurred the column order as a rule prevailed, *i. e.*, words often were reproduced in the original column regardless of the number heading it. Introspections from the maturer students concur in showing that the numbers as a rule were learned as to column then the words in like manner, and that despite the directions number-word association was not always made. Two subjects out of 50 said they did not see the number at the end of the column, on study, at all. Most said they studied columns 1 with 3 and 2 with 4. Because of the obvious difficulty in handling the data there was really more confusion than the tables reveal.

Two hundred and seventy-eight school children, from the sixth grade to the high school, of Honesdale, Pa., and 195 chil-

* A later test has proved more desirable: "The tailor bought the coat from the merchant. The farmer sold the pig to the baker. The baker sold the bread to the butcher."

dren from the schools of Bloomfield, N. J. were given the same test. The first schools were given 5 minutes to learn; the second 8 minutes (high school 7 minutes). Both schools were given 3 minutes for each recall and surprised by request for a second recall after 1 day. In all the tests with this experiment after the second recall a list of the numbers and words were presented in two columns distributed by chance and the subjects were asked to reconstruct them associating the words with their respective numbers. Honesdale schools were also tested unexpectedly after 3 weeks. The data for the third recall, and for reconstruction are not considered here. Both these schools were tested by Mrs. Myers; the other tests were made by the writer. Much credit is due Superintendents Oday and Morris for their hearty coöperation.

TABLE II
Average Per Cent. Correct Recalls in Correct Order

	Subjects	Honesdale						Bloomfield				
		Words	Figures	Words	Figures			Words	Figures	Words	Figures	
		Immediate Recall	Recall After 1 Day	Immediate Recall	Recall After 1 Day			Immediate Recall	Recall After 1 Day	Immediate Recall	Recall After 1 Day	
High School												
F.*	87	72.4	66.2	74.4	69.2							
M.	72	70.0	54.6	74.3	71.8	M.	29	92.1	80.3	80.6	50.3	
T.	159	71.3	60.9	74.4	70.4							
Eighth Grade												
F.	22	94.3	67.4	61.4	38.8	F.	68	90.1	79.9	68.9	54.3	
M.	25	65.2	59.0	84.7	62.7	M.	48	78.0	68.5	52.5	35.7	
T.	47	78.8	62.9	73.8	51.5	T.	116	85.1	66.6	62.1	46.6	
Seventh Grade												
F.	24	49.4	34.9	62.4	35.2	F.	25	85.2	74.7	56.0	46.0	
M.	11	70.6	49.1	43.2	15.4	M.	25	82.5	65.6	62.6	46.9	
T.	35	56.1	39.7	53.3	27.4	T.	50	84.4	70.1	59.3	46.4	
Sixth Grade												
F.	19	48.6	40.7	57.8	46.2							
M.	18	77.0	48.4	66.2	53.2							
T.	37	60.0	43.7	61.9	49.6							
Total												
F.	152	66.3	58.9	67.8	56.5	F.	93	88.8	78.5	59.6	52.1	
M.	126	70.1	54.1	72.4	62.5	M.	102	83.1	71.1	63.0	42.6	
T.	278	69.1	56.3	69.9	59.3	T.	195	85.8	64.4	61.3	46.6	

* F=girls; M=boys; T=total.

The percentage of correct words and figures which were properly recalled is given in Table II. As in the other experiment, increased confusion is shown after a day but the increase is very pronounced and invariably obtains for figures and for words for the respective grades and for each sex, as well as for totals. There is no marked sex difference that is common to the several grades and to the two schools.

Considered from the viewpoint of the number of cases who had, in second recall, equal, greater, or less percentage of correct recalls than they had in the first recall, Table III shows that while a high proportion have the same, the number of cases whose second recall is inferior to the first is much greater than those whose second recall is superior. However, it is surprising that so many should improve the quality of their answers with time as indicated by the greater cases. In these cases time clarifies rather than confuses. For all the Honesdale schools, who had shorter time (5 min.) for learning, the number of "equal" cases for figures are fewer and the number of "less" cases are greater than for words. Therefore, with the number of "greater" cases about the same for words and figures, more tend to increase in confusion with figures than those who increase with words. However, the group percentages of Table II do not suggest this fact. Consequently, those who do confuse must confuse relatively to a less degree with figures than with words.

In spite of the increased confusion with time as revealed by the decrease in quality of delayed recall over immediate recall, the total correct responses regardless of position are, on the whole, greater in delayed recall than for immediate recall both for words and figures (Table IV). This is pronouncedly true for each sex of the high school and eighth grade but is not constant for the seventh and sixth grades. For the upper grades, therefore, the quantity of delayed recall is better than for immediate recall, while the quality is inferior. Probably the content, as one would naturally expect, was deemed relatively more important, and consequently clung better for delayed recall than for immediate recall. Indeed, the emphasis upon order in immediate recall doubtless inhibited considerably in recall of mere materials. It is significant that the predominance of content over order is more manifest in the higher grades and that the girls excel the boys in content, both for words and

TABLE III

Honesdale Schools

Number of Cases in Second Recall Who Had Equal (0), Greater (+), and Less (—) Percentage Than in First Recall

Subjects (F. and M.)	In Correct Order				Without Regard to Order			
	High School		Eighth Grade		Seventh Grade		Sixth Grade	
	Words Cases	Figures Cases	Words Cases	Figures Cases	Words Cases	Figures Cases	Words Cases	Figures Cases
159	0 55	0 36	0 32	0 75	0 32	0 75	0 32	0 75
	+ 37	+ 45	+ 70	+ 55	+ 70	+ 55	+ 70	+ 55
	— 67	— 78	— 57	— 29	— 57	— 29	— 57	— 29
Eighth Grade								
47	0 16	0 6	0 7	0 20	0 7	0 20	0 7	0 20
	+ 9	+ 4	+ 21	+ 15	+ 21	+ 15	+ 21	+ 15
	— 22	— 37	— 19	— 12	— 19	— 12	— 19	— 12
Seventh Grade								
35	0 16	0 6	0 2	0 16	0 2	0 16	0 2	0 16
	+ 7	+ 4	+ 14	+ 10	+ 14	+ 10	+ 14	+ 10
	— 12	— 25	— 19	— 9	— 19	— 9	— 19	— 9
Sixth Grade								
37	0 17	0 2	0 4	0 16	0 4	0 16	0 4	0 16
	+ 6	+ 10	+ 9	+ 12	+ 9	+ 12	+ 9	+ 12
	— 14	— 25	— 24	— 9	— 24	— 9	— 24	— 9
Total								
278	0 105	0 51	0 45	0 127	0 45	0 127	0 45	0 127
	+ 60	+ 64	+ 113	+ 92	+ 113	+ 92	+ 113	+ 92
	— 116	— 166	— 120	— 59	— 120	— 59	— 120	— 59
Bloomfield Total								
195	0 45	0 36	0 36	0 36	0 36	0 36	0 36	0 36
	+ 48	+ 62	+ 62	+ 62	+ 62	+ 62	+ 62	+ 62
	— 102	— 97	— 97	— 97	— 97	— 97	— 97	— 97

figures. No such sex-difference obtains for correct order unless the advantage is slightly with the boys (see Table II).

With the same experiment, 50 normal school girls who on the average took 7 min. 40 sec. to learn and 2 min. 20 sec. to recall, were tested individually. Their second recall was made in a group after 3 weeks. This was followed by the reconstructive test arranged by chance. Forty-one reconstructed more correct words and figures than they recalled. Four cases fewer, and 5 the same. For figures the respective data are 23, 8, and 19. On the average 5.16 more words were reconstructed in their proper places than the number thus recalled.

TABLE IV

Average Number of Words and Figures Correct Regardless of Order

Honesdale Schools

		Words		Figures	
		Immediate Recall	Recall After 1 Day	Immediate Recall	Recall After 1 Day
High School					
F.	87	12.7	12.9	8.6	9.2
M.	72	10.3	10.7	8.5	9.5
T.	159	11.6	11.9	8.6	9.3
Eighth Grade					
F.	22	11.7	11.7	9.5	9.7
M.	25	9.5	10.6	7.8	8.9
T.	47	10.5	11.1	8.6	9.3
Seventh Grade					
F.	24	9.4	9.2	5.7	5.7
M.	11	9.5	8.7	6.2	6.9
T.	35	9.4	9.0	5.8	6.1
Sixth Grade					
F.	19	9.9	9.4	8.1	7.8
M.	18	9.9	6.7	6.9	7.7
T.	37	9.9	8.1	7.5	7.8
Total					
F.	152	11.7	11.7	8.2	8.6
M.	126	10.0	9.9	7.9	8.9
T.	278	10.7	10.9	8.1	8.7

While reconstruction gives far better records than recall, it is surprising that there should be any cases that did worse in reconstruction than in recall. Some showed, however, that the order they selected for the units was greatly influenced by the order as presented in the random group.

Their records for immediate recall were 97.2 per cent. and for recall after 3 months 65.7. For figures, they were 94.8 and 38.6 per cent., respectively.

Nineteen other girls of the same school were also tested for immediate recall, recall after one day and recall after 6 months. The records for words in the successive recalls were 95.7, 76.2 and 35.1 per cent., and for figures, 97.4, 66.2 and 13.2 per cent.

Twenty college men with the same test gave a percentage for immediate recall of 85.6 and for recall after 2 days of 65.7 for words and of 80.2 and 43.3 for figures.

In all the tests incorrect words and figures were exceptional and most of such that were given bear a close relation in form or meaning to the original words. This is in keeping with other findings of the writer.¹

On the whole, therefore, while the total number of correct units recalled after one day is, as a rule, greater than for immediate recall, those units properly associated are decidedly fewer. On the average, confusions in immediate recall approximately ranged from 30 to 40 per cent.; in recall after a day, from 40 to 50 per cent.; recall after three weeks 65 per cent. and recall after 6 months, 85 per cent. Therefore, of the answers given there was a tremendous tendency at confusing the position of the several units which had been in correct or partially correct position, and confusion increased with time.

PEDAGOGICAL SIGNIFICANCE

Just why A, for example, which when learned and recalled as properly associated with B, should later be recalled as associated with C, is not easily explained. Perhaps the explanation for most is in the erratic associates made during the study process. Even the weaker associates which gave place to the correct one in immediate recall, may be strengthened sufficiently as a result of later experience, to become the predominant associate at the time of delayed recall. Furthermore, unlearning experiences may have inhibited casual recall of the right associate, or its linking up with strengthening associates, or even the associations and emotional experience at the time of the delayed recall may favor the associate wrongly suggested in the first study. There is no certainty, of course, that all confusion was suggested in the first learning.

Whatever the cause, no doubt exists as to the prevalence of confusion in delayed recall. Every teacher is familiar with the patent type of answer which is in itself correct but which is not correct in response to the question asked. In the average written examination, doubtless the confusion errors preponderate over the errors of omission. It seems human to try to make some kind of a response to a situation and in consequence thereof,

¹ MYERS, G. C. *A Study of Incidental Memory*, Arch. of Psychol. November 26, 1913. Pp. 64-65.

MYERS, G. C. *A Comparative Study of Recognition and Recall*. Psychol. Rev., 21. November, 1914. Pp. 449.

one makes incorrect answers not so much because one cannot get an associate as it is because wrong associates obtrude themselves and seek expression.

In the learning process, then, wrong associates as far as possible should be prevented and every effort should be made to fix the right associate beyond doubt. Therefore the greatest care should be exercised to insure correct recitation because of its relation to the class as well as to the reciter. More important still, it is, that children perceive facts in their proper relations during study. Wherever possible the pupil should be led to make clear, definite classification of what he studies, so that there may be some strong points to which he can hitch the minor points of his lesson as he learns. He needs constantly to keep these "hitching posts" in view. Not only in the first learning, but in relearning and reorganization the learner should be guided so as to keep each element of his knowledge eternally associated with its proper mate. This study, furthermore, seems to emphasize the importance of drill.

COMMUNICATIONS AND DISCUSSIONS

THE PAINTED CUBE CONSTRUCTION TEST¹

There is already a great host of mental tests, and we need experimentation with these instead of the invention of new ones. But occasionally a new test is devised which serves a special purpose not satisfied by any test previously described. Such a test is the Painted Cube Test, which has at least four special advantages, namely, it is a good "plus or minus" test of high-level intelligence, in this capacity it also calls forth many qualitative differences in mental reactions, it is in a measure a good means of testing for mental imagery, and it can be used as a means of measuring the upper levels of intelligence with blind and with deaf subjects.

This test was first described to me by Dr. J. M. McCallie,² who had used it to some extent in estimating the intelligence of eighth grade pupils. As employed by Dr. McCallie the test was given verbally, without apparatus. His instructions were: "Imagine a cube, three inches on each side, and painted all over on the outside. Now, suppose this cube were to be cut into inch cubes; how many of these inch cubes would be painted on three sides, how many would be painted on two sides, how many painted on one side, and how many painted on no side?" The subjects were also asked to explain their methods of obtaining the result, and to describe the accompanying imagery. He found that only a small minority of eighth grade school pupils were able to give the correct answer.

It seemed to me that this test might be used to better advantage as a test of intelligence if it were given with concrete material and with a correspondingly different procedure. This modification should make the test more adaptable to special types of language defectives, should tend to eliminate the aid of special imagery, and should provide a sort of manual-intellectual construction test which could be solved either by doing (trial and error) or by reasoning (analytic-synthetic thinking). The use of apparatus also makes the test practicable as a measure of high-level intelligence with blind and with deaf subjects, with whom the other procedure would not be satisfactory.

¹ Exhibited at the meeting of the Am. Psy. Assn., New York, Dec., 1916.

² Dr. McCallie has used this test since 1896, for his own purposes. It has also been used by G. H. Betts ("The Distribution and Functions of Mental Imagery," Teachers College Contributions, 1909), by F. E. Bolton ("Principles of Education," 1910), and by H. O. Rugg ("The Experimental Determination of Mental Discipline in School Studies," Educational Psychology Monographs, 1916).

Apparatus. The material for giving the test manually consists of 27 inch cubes of smooth, hard surface (Milton-Bradley kindergarten cubes, for example), eight of which are painted (with blind subjects, roughened) on three sides, twelve on two sides, six on one side, and one on no side.

Procedure. These cubes are strewn before the subject in a miscellaneous pile. The subject is told to "Take these cubes and build up a cube which shall be painted all over on the outside." The reaction time is recorded with an ordinary watch, but the examiner assures the subject that haste is not a major consideration. The examiner records especially the reaction procedures which the subject employs. He also requests the subject to describe and rationalize the mental processes which he employed, and the accompanying mental content. The reaction-method, whether viewed from the standpoint of introspection or of behavior affords unusual insight into the subject's type of thinking.

Results. We have not yet attempted to standardize this test with statistical accuracy. Judging from tabulated results from giving the test, with apparatus, to about twenty-five successful business men and advanced students in psychology, it appears that those who succeed complete the cube in from about three to twelve minutes. But it is astonishing how many of these subjects used the trial and error method, without analysis of the problem, and without caution in checking results. Many had no idea how many cubes should constitute one side of the completed cube; some subjects built as many as five on a side. Others who failed to employ analytic thinking did check the manual method as they proceeded with the test, but only a very few made such use of their minds as one likes to think Nature intended they should. As a test of intelligence level this test appears to measure superior average adult intelligence, as judged by these results and by others obtained from exceptionally bright children between 10 and 15 years of age, and with some adults of average and inferior average intelligence. For this purpose the speed of reaction is not so important as the type of reaction, when the speed is under about ten minutes. In other words, the test is a good qualitative measure as well as an age-level test. Success consists in finally obtaining a built-up cube painted completely on every side.

Blind and Deaf Subjects. This seems to be an excellent test with intelligent adolescent and adult subjects deprived of sight or hearing. Preliminary results indicate that with the blind it is a reliable measure

of superior intelligence, and with successful subjects is completed in from about eight to eighteen minutes. Miss Edith Taylor, to whom I am indebted for this information, writes that in addition there are striking differences in the mental contents of the congenitally and the "accidentally" blind subjects. The test has not yet been employed with deaf subjects, but from theoretical considerations should prove satisfactory.

This test appears relatively independent of special instruction and can be solved rationally without use of language or imagery. It is a problem, however, to discover the effect of these lacks in the test.

E. A. DOLL.

Vineland, N. J.

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EDITORIAL

In the economic world, as in the field of biology, natural selection and the survival of the fittest have dominated the course of development. The struggle of competition is intense. Of VOCATIONAL SELECTION the hundreds who enter any line of occupation only a few achieve success. Many of those who spend years in preparation or apprenticeship find themselves misfits, and are either entirely eliminated or drag out a routine existence as mere counters in the game. Thus in business, as elsewhere, we find natural selection very prodigal of life, very wasteful of time and energy. As society becomes more highly organized, more clearly conscious of its own strivings, it endeavors to facilitate the process of selection by artificial means, to utilize natural and human resources to their utmost, and to conserve time, energy, and human effort. Accordingly, we have the deliberate breeding of plants and animals for human needs, the eugenics movement in human biology, the great expenditures of money and thought upon modern universal education, and latterly the focusing of all the resources of applied psychology upon commerce and industry.

An interesting recent instance of the application of conservation methods to business is the establishment by the National Bank of Commerce in New York City of a Division of Employment and Education under the supervision of a trained psychologist. This bank, which is one of the largest in the country, has on its pay-roll between four and five hundred employees,—a number large enough to make many of our small colleges envious. The aim of the new division, according to the statement issued by the bank, is to “standardize scientifically the methods of selecting and training the employees of the institution. A careful analysis will be made of the sources of recruits, and of the influence of past training and life conditions upon the efficiency of each type of recruit, and upon the probable length of time that each one will remain actively in the work.

“A second line of procedure is the standardization of methods of selecting men for each special type of work, involving an analysis of the traits required for success in each line, as well as an analysis of each applicant to see whether he meets these requirements. Psychological tests will be adopted as aids in selecting employees and in estimating the value of each man to the firm. A special feature of this work will be the maintenance of a clinic along psychological lines to assist the employees in determining their special abilities and aptitudes. One of the important features of the selection of employees is the establishment of coöperative relations with universities, schools and other sources, so that the best material can be brought into the bank for training. Search will be made for young men of exceptional ability and training, who are interested in banking as a life work and who see in it a medium for developing the country’s present and future resources.

“The second general feature of the work of the new division will be the more complete organization of a system of instruction designed to meet both the general needs of the employees, and the particular needs of each individual in the special line of work to which he has been assigned. This instruction will anticipate the needs of the men, and will place them in line for promotion. The basic idea in this is to make a course of instruction to fit the needs of the individual and of the institution, to the mutual advantage of both. A regular course of instruction embracing economics, commerce, banking and allied subjects, as well as the more elementary phases of bank work, will be established. The underlying purpose of the plan is to give practical training and at the same time develop the men along broad lines,

not merely as employees in a bank, but as individuals who can take their places in promoting and developing the resources of their country and of the commercial world. Thus the work is to be democratic, and is to be responsive to the desires of the employees as their needs arise from time to time. It is another concrete instance of the great movement in vocational education and vocational guidance that is now making itself felt."

It is worthy of special note that the foregoing program calls for an analysis of the factors that make for success in the various lines of banking work. If this can be carried out it will furnish a valuable contribution to the subject of vocational psychology. As Ayres has frequently pointed out, most of our efforts to use mental tests in vocational selection are nullified because we do not know what specific traits are characteristic of the successful man in the several vocational fields. The few sporadic attempts at the investigation of this question have yielded chiefly negative results. For example, engineers make little use of the mathematics that they are taught in school; classically trained students make as good a showing in the medical school as scientifically trained students; and shrewd men of affairs fail on some of the Binet tests of intelligence. We need much more intensive and prolonged studies of the essentials of vocational fitness. These should be conducted along two lines: first, an analysis of the characteristic traits of men who have succeeded in given lines of industry and a determination of the factors that were significant in their success; and second, a similar study of those who have failed and an inquiry into the reasons for their failure. When we have discovered, even in a vague way, the essential traits of a given industry, we can then more intelligently attack the problem of devising tests which will reveal the presence or absence of these traits in an individual, and of determining the prognostic value of such tests for the future success of the individual in the industry in question.

J. C. B.

NOTES AND NEWS

A Standard Score Card for Measuring Handwriting has recently been issued by Dr. C. Truman Gray of the University of Texas. The score card contains nine general rubrics, to each of which is assigned for a perfect score a certain number of points out of a total of one hundred. The assignment of these points was made on the basis of the author's recent monograph on the "Measurement of Handwriting," and is as follows: Heaviness, 3; Slant, 5; Size, 7; Alignment, 8; Spacing of Lines, 9; Spacing of Words, 11; Spacing of Letters, 18; Neatness, 13; and Formation of Letters, 26. The last rubric is divided into the following sections: General Form, 8; Smoothness, 6; Letters not Closed, 5; Parts Omitted, 5; Parts Added, 2. If each pupil's handwriting were scored at the beginning of the term on the basis of such a score card, the teacher would be greatly aided in focussing the pupil's attention upon the defects which should be remedied.

The experiment undertaken jointly by Teachers College and the New York City Board of Education at Speyer School something over a year ago is yielding interesting results. At the beginning of the school year 1915-1916 there were admitted to the school two hundred seventh grade boys who indicated, with the approval of their parents, their intention of taking the Latin course in the high school. These boys were divided into classes of twenty-five each, on the basis of extended mental and educational tests, supplemented by the subsequent judgments of their teachers. The aim was to secure as nearly homogeneous groups as possible and to adjust the work of the class to the capacities of the pupils. The teachers were carefully selected for their ability and their sympathy with the undertaking, but according to their own testimony they found no little difficulty in breaking the tendency to keep their classes together, and to conduct classes of bright and dull pupils in the same manner. Gradually differentiation of treatment has been attained, and skill in adjusting the work to differing aptitudes has been gained. The brighter groups will undoubtedly be able to do three years' work in two, while the duller ones will have gained a better mastery of the material than if they had been swallowed up in the ordinary mixed class. This attempt to employ mental tests in securing homogeneous groups of pupils is a significant step in educational procedure and the detailed reports of the results will be awaited with keen interest.

For the purpose of coöperating with various public schools in the use and interpretation of standard educational measurements, Dr. John W. Todd, of the departments of psychology and education in the University of North Dakota, has opened a bureau of educational measurements. The various tests are to be sent out to the schools that enroll in the bureau, used in the different grades, and then returned for tabulation.—*School and Society*.

At the University of Minnesota a short course for superintendents and principals will be held April 4 to 7 under the auspices of the State Department of Education and the College of Education. The special lecturers will be Dr. Leonard P. Ayres, Russell Sage Foundation, and Dr. Thomas D. Wood, professor of physical education in Teachers College.

Between March 16 and March 31 Professor C. E. Seashore of the University of Iowa will deliver a course of six lectures at the Harris Teachers College, St. Louis, Mo., on the subject "Vocational and Avocational Guidance in Music." The topics to be considered in the several lectures are (1) An inventory of the elements in musical talent, with illustrations of the method of charting measurements. (2) Tonal hearing and control of pitch, with methods of measuring the sense of pitch and the evaluation of ability in this respect for success in musical attainments. (3) Consonance and musical feeling. (4) The sense of time, rhythm and rhythmic action. (5) Musical memory, imagination and intellect. (6) A system for the survey of musical talent in the public schools.

The publishing house of Moffat, Yard and Company announces two series of forthcoming books under the general editorship of Dr. George Van Ness Dearborn. The first series will be entitled *The Life of the Child*, and will include works on the anthropology, anatomy, physiology, psychology, ethics, aesthetics, economics, mental defects, delinquency, happiness, hygiene, bodily defects, morbidity, and educational evolution of the child. The second series will be entitled *Our Senses*, and will include volumes on *Vision*, by Frank N. Spindler; *Hearing*, by Robert M. Ogden; *Taste*, by H. L. Hollingworth and Albert T. Poffenberger, Jr.; *Smell*, by Eleanor A. McC. Gamble; *Kinaesthesia*, by George V. N. Dearborn; *Pain and Pleasure*, by Henry T. Moore; *The Dermal Senses and General Sensations*, by Smith Ely Jelliffe; *Sensations of the Lower Animals and of Plants*, by Ada Watterson Yerkes and Robert M. Yerkes; and *Abnormal Sensations*, by Isador H. Coriat.

Professor H. G. Childs, of Indiana University, is spending the spring semester on leave of absence at Teachers College, Columbia University.

Owing to the death of Professor Münsterberg, several changes have been made in the courses for the second half year in psychology at Harvard University. Dr. Roswell Angier, assistant professor at Yale University, will conduct the seminar course. Assistant Professor Langfeld and Dr. L. T. Troland, of Harvard, will conduct the other courses in the department.—*School and Society*.

Professor Lewis M. Terman, of Leland Stanford Junior University, and Professor M. E. Haggerty, of the University of Minnesota, will give courses in mental tests and educational psychology at Teachers College, Columbia University, during the summer session.

Dr. Frederic Ernest Farrington has accepted the headmastership of the Chevy Chase School for girls at Washington, D. C.

Dr. Clayton C. Kohl, associate professor of secondary education in New York University, has been advanced to a full professorship in that institution.

Dr. John W. Withers, president of the William T. Harris Teachers College, of St. Louis, has been elected superintendent of the St. Louis schools to succeed the late Ben Blewett.—*School and Society*.

Dr. F. C. Ayer, professor of education in the University of Oregon, has been appointed professor of school administration in the State University of Iowa.

Mr. Dwight L. Hoopingarner, formerly tutor in educational psychology at the University of Texas, and more recently research fellow in the Bureau of Salesmanship Research, of the Carnegie Institute of Technology, has been appointed director of the division of employment and education in the National Bank of Commerce, New York City.

PUBLICATIONS RECEIVED

Annual Report of the Massachusetts Commission on Economy and Efficiency for 1915. Boston: State Printer, 1916. Pp. 304.

This report furnishes many illustrations of the saving that can be accomplished by a well organized efficiency commission. The danger is that the commission overlooks its function of helping on the work of the different departments and endeavors merely to save money. That way lies friction and inefficiency. In Massachusetts, fortunately, the commission seems to interpret its function in the broadest and most helpful terms.

LEONARD P. AYRES. *School Organization and Administration.* Cleveland: The Survey Committee of the Cleveland Foundation, 1916. Pp. 135. Twenty-five cents.

Urges the Board of Education to define its functions and duties, to concern itself with getting things done and stop attempting to do so many of them itself, to place the responsibility upon the superintendent of schools for the conduct of the school system and to allow him a relatively free hand. It is of interest to note that the school board has since adopted these recommendations in their entirety.

LEONARD P. AYRES AND ADELE MCKINNIE. *The Public Library and the Public School.* Cleveland: The Survey Committee of the Cleveland Foundation, 1916. Pp. 93. Twenty-five cents.

The day of the single reading book has past. Both teachers and public are realizing that pupils must learn to read as they learn to talk,—through unremitting exercise. The survey recommends that school libraries be established in or near each new school building, that well equipped libraries and trained librarians be supplied for all junior high schools, that the salaries for school librarians be on a level with those paid teachers doing corresponding work, and that a corp of teacher librarians be organized under the direction of a supervisor of school libraries.

W. C. BAGLEY AND H. O. RUGG. *The Content of American History as Taught in the Seventh and Eighth Grades.* Bulletin No. 16, School of Education, University of Illinois, 1916. Pp. 59.

This monograph is based on an analytical study of the material contained in twenty-three elementary text-books in American history, published between the years 1865 and 1912. The delineation of the characteristics of these books is very interesting reading. The relative amount of space in each book devoted to each of nine periods of United States History is presented in tabular form. It is interesting to note that the space given to the Revolutionary War has steadily decreased, while that devoted to the National Period, 1783 to 1861, has steadily increased. The chief men and events have been

selected for each of these periods, and their relative importance is indicated in terms of the frequency of reference to them. Abraham Lincoln heads the list of those eminent in civil life, and when his frequency is set at 100, others have the following values: Washington 84, Jefferson 82, Jackson 49, John Adams 46, Madison 40, Hamilton 37, Henry Clay 33, J. Q. Adams 29, Monroe 23, Franklin 23, Patrick Henry 21, Van Buren, Calhoun, and Webster 20 each. The authors conclude that elementary American history is still predominantly political and military, although in recent years there is a tendency to stress economic and industrial development.

JAMES BALDWIN. *Fifty Famous Rides and Riders*. Cincinnati: The American Book Company, 1916. Pp. 303.

It may be a vestige of the primitive that still sways our moods, but the spirited account of a wild ride stirs the blood of even the most prosaic of us. Perhaps we have never backed a horse in our lives, but our imaginations suffice to conjure up the scene of the ride and to set our pulses tingling with the excitement of it. Here is a book that will interest both young and old. All the familiar favorites are here from John Gilpin onward, and many others that you never heard of. It is a splendid supplementary reading book.

FRANK W. BALLOU. *Penmanship. Determining the Achievement of Elementary School Graduates in Handwriting*. Boston: Bulletin No. IX of the Department of Educational Investigation and Measurement, Boston Public Schools, 1916. Pp. 43.

A test in copying was given to 4494 pupils in the first-year classes of fourteen Boston high schools. From these papers 600 were taken at random by selecting every eighth paper, divided into two groups of 300 each, and graded by three judges for each group. The basis of the grading was the Ayres scale for adult handwriting, using only the samples 10-30-50-70-90, and disregarding the even tens on the scale. Of the 600 specimens 8.5 per cent. received the rating of 90; 40 per cent., 70; 42.2 per cent., 50; and 9.3 per cent., 30. There were no ratings below 30. The bulletin contains an interesting discussion of the variations in the judgments, and a critical analysis of the merits and defects of the handwriting studied.

M. L. BEANBLOSSOM. *Mental Examination of Two Thousand Delinquent Boys and Young Men*. Jeffersonville, Indiana: Indiana Reformatory, 1916. Pp. 23.

No attempt was made to determine the "mental age" of the boys examined, but they were divided into ten groups (good, fair, and poor mentality, subnormal, moron, imbecile, specialized defective, dull from somatic causes, psychosis, and unclassified) on the basis of general considerations and previous history, and the results of certain Binet tests, general intelligence tests (cancellation, dot, motor

coördination, comprehension, inset board, instruction box, information, controlled association, and fidelity of report), and educational tests (Courtis arithmetic, Starch reading, and Trabue language). Tables show the distribution of the boys in these groups, correlations between various tests, norms from 200 inmates on certain tests, and results of the Kent-Rosanoff and the Binet tests. The report seems rather loosely thrown together, and of somewhat doubtful scientific worth. Perhaps those engaged in clinical work may find it of some practical value.

VIKTOR BLUETGEN. *Das Peterle von Nürnberg*. Edited by Frederick James Menger. Cincinnati: The American Book Company, 1916. Pp. 207.

A charming little story suitable for second year German.

ALICE C. BOUGHTON. *Household Arts and School Lunches*. Cleveland: The Survey Committee of the Cleveland Foundation, 1916. Pp. 170. Twenty-five cents.

The report discusses the development of household arts in elementary schools in the United States, infant hygiene, household arts in the high school and the organization and administration of the lunch service in both elementary and high school. Two types of organization are discussed, first, lunches furnished by concessionaires for their own profit; second, those provided by educational employees who aim to put the extra profit back into increased food and better service. The Cleveland system belongs in the first class. The survey recommends a change to the second type, centralization and consolidation, and supervision by an experienced dietitian.

W. E. CASTLE. *Genetics and Eugenics. A Text-book for Students of Biology and a Reference Book for Animal and Plant Breeders*. Cambridge: Harvard University Press, 1916. Pp. vi, 353.

This is a weighty book both literally and figuratively. It is printed on heavy glazed paper and is thus remarkably heavy for its size. In technical construction the book is admirable. The illustrations are so numerous as to be profuse and there are several plates printed in delicate colors. In content the book may be considered thoroughly reliable and authoritative. The author has attempted to present "in a form as simple and readily intelligible as possible the subject of heredity, as related to man and his creatures, the domestic animals and cultivated plants." Part I, Genetics, treats of such topics as Darwin's theories of evolution and pangenesis, the contributions of Lamarck, Weismann, and Herbert Spencer, the question as to the inheritance of acquired characters, biometry, the mutation theory, Mendel's law and the recent discoveries supporting it, the nature and presence of unit characters in common animals, sex-linked inheritance, sex determination, Galton's law of heredity and his principle of regression, inbreeding and crossbreeding. Part II, Eugenics,

deals with human crosses, physical and mental inheritance in man, the heredity of general mental ability, insanity, epilepsy and feeble-mindedness, and the possibility and prospects of breeding a better human race. The discussion is scientific but not too technical for an educated person to read and almost every chapter is replete with interest. Part II is naturally of the most significance for psychologists. The author does not find himself in great sympathy with those eugenic sociologists who believe that human mating should be controlled by the state. "As individuals primitive men were probably more than a match for us physically, and at least our equals mentally. As regards the standard of the individual, then, the race has not progressed. Civilization is a matter of collective achievement; it is not a biological inheritance at all, but a cultural one. Standing on the shoulders of the last generation we see farther because we are higher up, not because we are taller." The development of the argument is masterly and the book will undoubtedly take a high place in contributions to genetics. There is a carefully selected bibliography of twenty-five pages.

SARAH A. DYNES. *Socializing the Child. A Guide to the Teaching of History in the Primary Grades.* New York: Silver, Burdett and Company, 1916. Pp. x, 302.

In part one the author considers the theoretical basis of the value of history for the children of the first, second and third grades. She emphasizes the importance of a sympathetic relationship between teacher and child, the necessity for taking the child's experience as a point of departure in history study, of utilizing the child's communicative and dramatic impulses to make historical events vivid, and the function of the imagination in reconstructing the past. Part two gives detailed and specific recommendations for teaching history in the first three grades. Grade I centers about the relationships and activities of the family, Grade II is concerned with primitive man, the Eskimos and the Indians. Grade III outlines from the child's point of view life in Holland, Germany, Japan and France, and introduces the stories of Joseph, Ulysses, Alexander the Great and Columbus. This kind of study is vastly more educative than the grind of arithmetic and spelling which formerly burdened the children.

H. H. FICK. *Ich und Du.* Cincinnati: The American Book Company, 1916. Pp. 80.

This is a German reading book for children of the first grade. It is constructed with the wealth of illustration and excellence of workmanship which characterizes modern elementary reading books in English.

J. D. HEILMAN AND FRANK D. SHULTIS. *A Study in Addition.* Research Bulletin No. 1. Greeley, Colorado: State Teachers College, 1916. Pp. 16.

This is the type of study that we should see much more frequently coming from our normal and training schools. Twenty pupils were

chosen from the fifth and sixth grades, excluding those who knew all the addition combinations equally well, and those who were entirely ignorant of some of them. Each pupil was taken privately into a quiet room, the two numbers were presented orally, and the pupil called out their sum as quickly as possible. The time between the last number and the response was measured by a stop watch in fifths of a second, and was taken as a measure of the association. The following illustrate the results, representing extremes of readiness of association in fifths of a second: $7 + 9$, 18.89; $9 + 7$, 17.93; $6 + 9$, 17.09; $8 + 6$, 16.86; $5 + 8$, 16.84; . . . $4 + 4$, 6.47; $5 + 5$, 6.43; $1 + 1$, 6.08; $3 + 3$, 6.03; $2 + 2$, 5.72. It will be seen that $7 + 9$ requires over three times as long as $2 + 2$. Well-directed drill will reduce the association time on all these combinations to approximately one second.

RICHARD O. JOHNSON. *Analysis of Pupilage, Indiana State School for the Deaf*. Reprinted from the seventy-second annual report, September 30, 1915. Pp. 25.

In this report the author considers age-grade distribution, progress and retardation, degrees of deafness and retardation, and gives an account of the movement to establish intellectual norms for the deaf. It is probably the most detailed study of its kind that has ever been made, and promises well for a more intelligent and scientific treatment of the deaf.

RICHARD O. JOHNSON. *Outlines for the Guidance of All Connected with the Indiana State School for the Deaf*. Indianapolis: State School for the Deaf, 1916. Pp. 78.

This unique hand-book contains a brief history of the school, the calendar for work, notes on the course of study, the rules of the school, and a remarkably extensive and well-selected series of extracts from recent writings on experimental education. It is evident that the author believes it will do his teachers good to keep abreast of the experimental movement, and he proposes to encourage them in this endeavor.

EDITH KATHLEEN JONES. *Importance of Organized Libraries in Institutions*. Reprinted from the Proceedings of the Forty-third Annual Meeting of the National Conference of Charities and Corrections, No. 74, 1916.

Illustrates what may be accomplished by an institution library, and points out some of the pitfalls which are to be avoided in the conduct of such a library.

GEORGE ELLIS JONES. *Training in Education*. University of Pittsburgh Bulletin, Vol. 12, No. 17, July 15, 1916. Pp. 113.

This interesting monograph contains an introductory chapter on the basis of training, summarizing the most important contributions

to our knowledge of the modifiability of behavior, a discussion of the factors involved in training, and a description of typical school curricula based on activity. There is a bibliography of 120 numbers.

CHARLES HUBBARD JUDD AND SAMUEL CHESTER PARKER. *Problems Involved in Standardizing State Normal Schools*. Bulletin, 1916, No. 12. Washington: Bureau of Education, 1916. Pp. 141.

The introductory chapter on the scope of the bulletin gives a good summary of the various surveys and reports that have been recently made on normal schools, and indicates the sense in which the term standardization is used. Other chapters deal with the statistics of normal schools, practice-teaching facilities, faculties, courses of study, and a program for development of normal-school standards. In the latter section deserved emphasis is placed on productivity by members of the faculty. Every teacher in a normal school should be made to feel that the community expects him to do his part in widening the bounds of our knowledge as well as in teaching classes.

ISADORE KAYFETZ. *A Critical Study of the Harvard-Newton Composition Scales*. Reprinted from the Pedagogical Seminary, Vol. 23: 1916. 325-347.

The author thinks that it is a waste of time and energy to try to derive objective standards for the measurement of efficiency in composition, contends that we cannot judge a composition unless we know the writer's "age, grade, sex, nationality, general intelligence, school brightness, capacity for composition work, and social status," condemns dependence upon statistical treatment, and seems to consider it a heinous offense on the part of the author of these scales that he did not preface his work by an elaborate discussion of the standpoint of Meumann and Lay. Such criticism can scarcely be taken seriously.

ANTOINETTE KNOWLES. *Oral English, or the Art of Speaking*. New York: D. C. Heath and Company, 1916. Pp. vi, 361.

The need for better training in oral English is felt by high school teachers generally, and this feeling has given rise to a number of good text-books. The present text has many excellent features, such as suggestions for enlarging one's vocabulary and collecting choice expressions, planning a speech, oral rehearsals, the art of phrasing, how to use a library, the preparation of a brief, and introductions and conclusions. Each chapter is followed by a reading lesson illustrating the topic just discussed.

W. E. LARSON. *The Wisconsin County Training Schools for Teachers in Rural Schools*. Bulletin, 1916, No. 17. Washington: Bureau of Education, 1916. Pp. 40.

There are thirty county training schools in Wisconsin. This bulletin gives the law under which they are organized, outlines the course of study, presents an extended account of the work of the grad-

uates, and makes some suggestions for increasing the usefulness of these schools. On the whole they are rendering excellent service, and the plan is to be warmly commended to other states.

JAMES H. LEUBA. *The Belief in God and Immortality. A Psychological, Anthropological and Statistical Study.* Boston: Sherman, French and Company, 1916. Pp. xvii, 340. \$2.00.

This is an extremely interesting book on an important aspect of social psychology. Part I presents two historical conceptions of immortality; the ghost idea and the idea of a land of immortality. The history of these two conceptions as manifested in human beliefs is traced in some detail. Part II contains a statistical study of the belief in a personal God and in personal immortality amongst American college professors and students. It is interesting to note that the proportion of those who believe in immortality decreases from the freshman to the senior year. A study of the returns from a questionnaire sent to a thousand American scientists shows that only about one-third of them believe in God, and a slightly higher number believe in immortality. Part III considers the social origin of moral ideas and inspiration, and the utility of the belief in God and in immortality. The material is well presented, the style is smooth and readable, and the subject matter of the discussion is fascinatingly interesting.

JACQUES LOEB. *The Organism as a Whole, from a Physico-chemical Viewpoint.* New York: G. P. Putman's Sons, 1916. Pp. x, 379. \$2.50.

This book is intended as a companion volume to the writer's well-known *Comparative Physiology of the Brain*. The author tries to show that the unity of the organism is due to the fact that the egg is the future embryo, upon which the Mendelian factors in the chromosomes can impress only individual characteristics, probably by giving rise to special hormones and enzymes. This leads to the view that genus- and species-heredity are determined by the cytoplasm of the egg while the Mendelian hereditary characters scarcely contribute at all to the formation of new species. Of the fourteen chapters of which the book is composed the most interesting are perhaps those on regeneration, the mechanism of heredity, animal instincts and tropisms, and the influence of the environment upon the developing organism. The discussion presents many protests and arguments against the wide-spread conception of vitalism, and maintains throughout a mechanistic conception of life processes.

A. LAWRENCE LOWELL. *Liberty and Discipline: A Talk to Freshmen.* New Haven: Yale University Press, 1916. Pp. 16. Twenty-five cents.

In this address to the freshman class of Yale College the president of Harvard considers some aspects of American ideals suggested by

the present European conflict. The agencies of democratic civilization are now on trial. Whether they triumph or succumb depends upon the extent to which each individual voluntarily holds himself in subjection to the good of the group. It is a stirring appeal to the youth of the land to put lofty aims and high ideals above immediate satisfactions and petty jealousies.

JOHN T. McMANIS. *Ella Flagg Young, and a Half-Century of the Chicago Public Schools*. Chicago: A. C. McClurg and Company, 1916. Pp. 238. \$1.25.

In the present day when women are called upon more and more urgently to do their share of the world's work, and when the last barriers that have kept them from complete political, social, and economic equality with men are being broken down, it is fitting that we should have presented to us the life history of the woman who has attained to the highest administrative position in public school work that any woman has ever held. Mrs. Young's life is a story of steady, persistent, tenacious adherence to a purpose, to an ideal, to a lofty conception of service for the youth of the community in which she has lived. The book tells the story of her early life, of her training for teaching in the Chicago Normal School, of her work as teacher, principal, assistant superintendent, normal school principal, and superintendent of schools in the second largest city in the country. The conflict between politics and educational ideals in the conduct of the schools is clearly set forth, and while Mrs. Young was forced to give way to another administrative head, the account set forth in this book of the fight she waged with graft and political trickery will contribute materially to render such methods impossible in our schools.

WILLIAM MORRISON PATTERSON. *The Rhythm of Prose*. Columbia University Studies in English and Comparative Literature. New York: Lemecke and Buechner, 1916. Pp. xxiii, 193.

The sub-title of this monograph is "An Experimental Investigation of Individual Difference in the Sense of Rhythm." There is an interesting historical account of the work of Wundt's school, of American psychologists, and of Sievers and his school on the subject of researches in linguistics. The author then attacks the psychology of the sense of swing, and follows this with an examination of rhythmic tunes drawn from barbaric and poetic sources. In spite of the claims of Sievers and others, the author thinks that there is no scientific basis for the application of speech-melody to textual criticism. Three extended appendices contain a description of the apparatus used in the experiment, the experimental procedure, and the experimental data. There is a bibliography of eight pages.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

THE RELATION OF CLASS STANDING TO COLLEGE TESTS

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As an introduction to systematic testing of our students at Newcomb College, a class of seniors and an almost equal group of freshmen were given an information test and 99 of the freshman class tried a series of standard tests in the spring term of 1916. Besides this general purpose the special object of the testing was to compare the achievement of these college girls with the results obtained elsewhere and to correlate the tests with their class grades. It therefore seemed best to use the more common tests already fairly standardized. The class grades are given in the letter system, A, B, C, D, E, F, to the students, but as the professors must make out the marks in per cents, the exact numerical grades were used in the calculations.

A selection was made from the various information tests of the more familiar literary and historical terms and names relating to the past; to these were added an equal number of terms that are being used in newspapers and magazines in connection with current events and names of people most conspicuous at the present time. As there were fifty terms in all, a credit of 2 was given for a correct answer complete enough to be definite, and a credit of one for a partially correct or an indefinite reply. Thus, if "Socrates" was identified merely as a philosopher, credit of 1 was due, if as a Greek philosopher, a credit of 2. Each student was given a typewritten list of the terms and told to write what each signified as definitely as possible. The freshmen numbering 25 and the seniors 32 were tested during a class period and allowed all the time necessary, as no one required more than the period to tell what she knew.

As is shown in Table I, the lowest score of the freshmen was 22, of the seniors 11; while the highest scores were 74 and 94 respectively. But the lowest 20% of the first-year group did better than the corresponding percentile of the seniors. The grades received by these freshmen indicate that they are neither the very best nor the worst of their class, while the senior group included those who received the highest grades in their class and not the lowest grade students. In all subjects that can be compared these seniors received higher marks than the freshmen, not in any course dropping as low as the latter do. On the other hand this group of freshmen have a higher median in class average, English and history than do the freshmen as a class. According to Table II, the coefficients show very low correlations between this information test and the subjects most commonly pursued by the students, as there are negative correlations between the scores in this test and the grades in mathematics and foreign languages, and the highest positive correlation is with history, while the correlation coefficients for the information test and the general average is only .13. For this particular group of students the correlation between mathematics and foreign language gives a coefficient .03, between mathematics and history .90, and between English and history .81. Among the seniors, the student who obtained the highest class average also made the highest score in the information test and the others who had a high rating in the test had class averages above the median. But those who made the lowest scores in the test also average above the median; in fact, the mean of their averages is exactly the same as that of those at the top. Among the freshmen the girl who made the highest score in the information test ranks third in class average. But the mean of the class averages of those at the bottom is again equal to that of the same number who are most conspicuously at the top. This relation is also shown by the fact that the correlation of the information test with the senior class average gives $r = 0$. The highest positive correlation, $r = .36$, is for this test with history of philosophy, and then in order with education, English, history, .29, .25, .24. The correlation between the test and the averages in foreign language is slightly negative. As compared with these coefficients the correlation between history of philosophy and history is .59, philosophy and English .52, and philosophy and foreign language .19.

TABLE I.
Information Test
 FRESHMAN GROUP

	Average	English	For. Languages	History	Mathematics	Information	Substitution IV.	Genus Species	Marble Statue	Part-Whole	Cancellation	Opposites
No. of Students.....	25	25	25	22	21	25	22	22	22	21	22	22
Lowest score.....	72	70.5	69	65	52	22	24	55	20	65	36	87.5
10%.....	75.3	72.1	70.3	67.5	56.5	23.3	34	62.5	29	72.5	37	90
20%.....	78	76	76.5	74	64	27	49	75	43.5	95	40	95
30%.....	79	79	79.3	75	67	32	56	80	46	95	44	95
40%.....	82.5	80.7	80.5	76	71	34.5	61	85	50.5	95	48	95
50%.....	84	81.8	82.1	78.5	75	38	67.3	85	53.6	98.3	50	99.1
60%.....	85	83.2	83.7	82.3	83.5	41	78	85	55.5	100	54	100
70%.....	85.6	84.6	86.1	85	87	44	82	95	58.5	100	60	100
80%.....	87.3	86	88	87.3	89	53.5	89.3	100	64	100	68.6	100
90%.....	89.5	87.5	94.1	89.6	92	68.6	99.5	100	68	100	86	100
Highest score.....	91	88	95	90	93	74	100	100	76	100	92	100
25%.....	76.7	74.3	73.7	71.4	61.4	25.8	43.6	71	38.2	86	39.2	93
50%.....	82	80.7	80.6	77.7	71.4	35.8	64	85	52.4	96	49.2	98.5
75%.....	85.6	84.3	85.5	83.4	85.8	44	80.8	94	58.4	100	58.8	100

SENIOR GROUP

	Average	Philosophy	For. Languages	English	History	Education	Information
No. of Students.....	32	30	18	18	10	20	32
Lowest score.....	82	78	74.5	80.5	85	80	11
10%.....	84	80	75.5	80.7	85	80	22.7
20%.....	85.6	82	85.7	81.5	86	82	33.6
30%.....	86.6	82.6	87.5	82	86.5	84.5	37
40%.....	87	83.3	90	84.2	87.5	85.5	40.6
50%.....	87	85	90.2	87	88	86.5	44
60%.....	88	86	90.75	88.5	90	89	50
70%.....	88.3	87.6	91.2	89	90	90	56.6
80%.....	90	89.7	92	90.2	92.5	91	63.3
90%.....	92.7	92.3	95.7	92.5	93.5	92	78.8
Highest score.....	93	94	97	92.5	94	93	94
25%.....	85.2	81.1	80.6	81.1	85.5	81.6	28.5
50%.....	87.1	83.8	89.5	84.2	87.7	85.8	40.5
75%.....	88.5	85.8	90.7	88.5	90	89.8	53

TABLE II.

Correlations

FRESHMEN

No. of Students	Subjects & Tests Correlated	Correlation Coefficients	
25	Information test & Av.	$r = .13$	
21	Information test & Math.	$r = -.19$	
22	Information test & Hist.	$r = .12$	
25	Information test & Eng.	$r = .07$	
25	Information test & For. Lang.	$r = -.07$	
22	Inf. test & Subst. IV.	$r = -.19$	
22	Inf. test & Genus-Species	$r = -.19$	
22	Inf. test & Marble Statue	$r = .19$	
21	Inf. test & Part-Whole	$r = .26$	
22	Inf. test & Cancellation	$r = -.17$	
22	Inf. test & Opposites	$r = -.25$	
21	Math. & For. Lang.	$r = .03$	
19	Math. & History	$r = .90$	
22	Eng. & History	$r = .81$	
25	Av. & Eng.	$r = .96$	
25	Av. & For. Lang.	$r = .96$	
21	Av. & Math.	$r = .91$	
22	Av. & Hist.	$r = .93$	
		Mean	Median
25	Eng.	82.1	82
25	For. Lang.	82.3	83
21	Math.	77.45	78
22	Hist.	79.06	80.5
25	Av.	83.6	85
25	Inf. test	41.48	39

SENIORS

No. of Students	Subjects & Tests Correlated	Correlation Coefficients	
32	Information test & Av.	$r = 0$	
30	Information test & Philos.	$r = .36$	
18	Information test & For. Lang.	$r = -.04$	
18	Information test & Eng.	$r = .25$	
10	Information test & Hist.	$r = .24$	
20	Information test & Educ.	$r = .29$	
	Philos. & Hist.	$r = .59$	
	Philos. & Eng.	$r = .52$	
	Philos. & For. Lang.	$r = .19$	
		Mean	Median
30	Philos.	85.7	85
18	For. Lang.	89	90
18	Eng.	86	87
10	Hist.	89	89
20	Educ.	87	88
32	Av.	88	88
32	Inf. Test	48.5	44.5

Whatever be the faults of such an information test, it certainly points out the lack of contact on the part of many college girls with the political and economic questions of today and gives an insight into the interests of the students which may not be disclosed in their work in required courses of study. In the case of the freshmen more than half of the correct answers pertained to the historical and literary questions that were based directly on the regular high school and college studies. The seniors, on the other hand, were more variable, being about evenly divided into those whose correct replies were based on knowledge retained from their school subjects, and those whose answers showed information gained through outside reading or intercourse. This difference may indicate a diversity in interests or it may be due to the fact that the more advanced college subjects require better information about current affairs, as courses in history and literature that concern present day life are so often placed among elective senior courses.

Besides this small group of freshmen who tried the information test, 99 were given a series of tests, mainly such as have already been standardized and seemed best adapted for group testing. In this way it might be possible to use the results for comparative purposes, though it was fully recognized that the difference in method between individual and group testing would affect the results. Still it was hoped that if the time limit could be standardized, more tests could be tried out and also be repeated several times on account of the saving in time by the group method.

1. *Color triangles*. This test was adapted from the one described by Bullough¹ and by Valentine² and the results were evaluated according to the aesthetic types suggested by these psychologists. Equilateral card-board triangles, 17.5 cm. on the side, were covered with colored papers so that the apex of the triangles (altitude 8.3 cm.) was of one color and the base of a different color, either darker or lighter. These triangles were arranged in ten pairs, each having the same color at the top in one triangle and at the bottom in the other. Thus if a light blue and a dark green were combined, the former would be at the apex in triangle A and at the base in triangle B of that pair. The color combina-

¹ BULLOUGH, EDWARD. *The "Perceptive" Problem in the Aesthetic Appreciation of Simple Colour-Combinations*. Brit. Jour. Psychol. III, pp. 406-447.

² VALENTINE, C. W. *Experimental Psychology of Beauty*. Pp. 21, 27-30.

tions of the different pairs of triangles according to the Bradley colored paper scale were (I) orange shade 2 and orange-red shade 2; (II) blue shade 1 and yellow; (III) violet tint 2 and violet tint 1; (IV) yellow-green tint 2 and green tint 1; (V) yellow and yellow-orange; (VI) green blue tint 1 and green blue shade 2; (VII) orange-red and green shade 2; (VIII) green-yellow and green-yellow shade 2; (IX) yellow-orange tint 1 and yellow-green shade 1; (X) yellow shade 1 and green-blue shade 2.

After the test had been explained to them, the students were shown first triangle A of each pair and asked, "Do you like A better?" and then as triangle B was shown, "Or do you like B better? Write your choice, I like A, or I like B better." Both triangles were shown together for a minute so that a comparison could be made and triangle A was always held up on the right and B on the left. After the choice had been recorded by each one, they were asked to give the reasons for their preference.

2. *Substitution test.* Mrs. Woolley's substitution test was used and each student was given the four blanks and the key, face down. The group was given definite instructions by the investigator, who adapted those used by Mrs. Woolley. At a given signal all turned the papers, began the filling in, and at a second signal all stopped and turned the blank face down before the signal was given for the next. When the first three blanks had been filled the keys were collected, and the figures on the fourth blank were written from memory. The time given for each of the four blanks in order was 2 minutes, 90 seconds, 75 seconds and one minute. At the end of the test all of the blanks were collected.

3. *Cancellation test.* For this test blanks with the hundred letters (in capitals) of the H P L G test were used and 90 seconds allowed between the first and second signals, when the blanks were immediately taken up by assistants. The blanks were first shown to the students, the test explained and explicit instructions given, and then the blanks were distributed face down. At the given signal the blanks were turned and the marking was begun.

4. *Marble Statue.* Pyle's directions were used with the addition, "In reproducing the story, try to get not only the main facts but also the details." The story was read to the girls and they were given all the time needed for writing the reproduction.

5. *Genus-Species.* The Woodworth-Wells test was used. Pyle's instructions were followed and one minute allowed between signals.

6. *Part-Whole.* The Woodworth-Wells test was used according to Pyle's instructions. The time limit was one minute.

7. *Opposites.* Mrs. Woolley's list 8 of opposites was used and 90 seconds allowed.

8. Half of this group of freshmen tried the word-building test, and all the rest who could see the figures, the Ink Blot test. For the latter test the first ten ink blots were displayed by the investigator for 30 seconds each and the students told to write all that was suggested by each blot. The other division was also given 5 minutes to carry out the following directions given them on printed slips: "Using the letters E A I R L P, make as many words as possible. The words must be real English words, no word must contain a letter not in the list, and no word must contain one of these letters more than once."

RESULTS

1. In the color triangle experiment only one student seemed to belong to the physiological type and one to the associative, 6 gave reasons partly objective and partly physiological, 3 combined objective, physiological and associative reasons, 9 objective-associative, and only one student, the same who obtained the highest scores both in class grades and tests, combined character judgments with objective estimates. The other 75% gave judgments that were apparently objective.

The red-green combination, triangle VII, proved a confusion triangle. Fifty-six students preferred red at the base, 51 of these otherwise choosing the A triangles in the majority of the cases, 40 preferred green at the base and 8 could make no choice between the triangles. It seemed that here on account of the doubt as to which hue was lighter or darker, the student would have to analyze her choice more carefully and that triangle VII might show a variance with the other judgments and perhaps a more analytical choice, especially in the case of the objective type. But the results did not verify this supposition. Those belonging to the objective class, whatever their choice, adhered to the same reasons as in the other judgments, and the more mixed types seemed not to make a special case of it.

Of the 99 students who gave their judgments on the color triangles, 10 preferred the darker color at the base, including VII A, 30 others made the same choice except in the case of the red-green combination, where they liked the red at the base better than at the top, and 3 chose the A triangles consistently except in one case, namely B in triangles I, II and VI respectively. Two students uniformly preferred the darker color at the top, because in that position it was more effective and attracted the attention first; and one girl made the same choice except in the case of the red-green (where she preferred A) on the ground of preference for the lighter color and liking the greater amount of it, which appeared when it was placed at the base. Four of the 10 preferring the darker color at the base did not give reasons of the objective type, but gave associations and pleasing or depressing effect of the arrangement as ground for their choice. Of the 33 in the second group, association predominates in 2 students, the physiological effect in one, and character judgments in a fourth. All the rest of these 55 girls gave judgments of the objective type, stressing balance, weight, amount, arrangement or contrast of color.

The rest of the 99 display such a miscellaneous choice that they seem impossible to classify, except that in the case of the red-green pair, they are about evenly divided in their preferences. This miscellaneous group contains 12 of the 20 whose preference was predominantly of the physiological, associative or character type. All the rest gave objective reasons for their choice. This classification of the objective type is unsatisfactory as in the final analysis the choice might come under one of the other types of judgment. But if the students are re-tested it may be possible to see what effect is produced by increasing maturity, college training and development of introspective ability. On account of the dubious interpretation of these results, it seemed futile to work out correlations of this test with the others. It may be of interest to note that of all the 99, six were evenly divided in their choice between the A and B triangles, and only 7 preferred the darker color at the apex in more than half the pairs, though, as has already been stated, over half of these students preferred this arrangement in one or more pairs.

In order to make comparisons with the class standings, all the results wherever possible were scored on the scale of 100. As each

substitution blank contained 50 figures, each figure filled correctly received a credit of 2. The first three sets of blanks were averaged and compared with the fourth. The correlation between the average of the first three blanks and the average of the fourth gives a coefficient .71 (P.E. .03). In substitution IV, though the average is only 35 (P.E. 8.36) and median 39, the mode is 50. The highest 25 percentile average 50, the lowest 18 and the middle 50 per cent. have an average of 38.

In the cancellation test also, every A crossed correctly counted 2. No letter except A was crossed out on any blank so no special calculation had to be made for errors.

In the Genus-Species and Part-Whole tests each correct answer scored 5.

In the Opposites test Mrs. Woolley's method of scoring was adopted, but it was found that additional words were given which were credited as follows:

Wise—ignorant (2), silly (2).

Busy—unoccupied (2), at leisure (2), inactive (2), resting (2).

Tender—harsh (2), cruel (2), callous (2), stern (2), unsympathetic (1).

Regular—uneven (2), absent (1), tardy (0).

Stale—new (2), good (1).

Heavy—slight (1).

Even—odd (2), irregular (2).

Certain—doubtful (2), doubt (1).

Silent—garrulous (2), talk (1).

Orderly—confused (2), careless (2), slovenly (2), sloppy (1), messy (1).

As the perfect score would be 40, every score was multiplied by 2.5.

In the "Marble statue" Pyle's norm of 67 ideas was taken as equivalent to 100, and the scores credited accordingly.

As it is possible to make 76 words in the Word-building test, this number was taken as 100 and credits assigned on the scale of 100. This method of scoring is probably unfair as at least 26 of the words given by Whipple³ are very unusual, or are proper names. If these 26 words, ai, al, April, ar, Ariel, aril, ea, ela, Eli, epi, eria, Ira, Lear, pelra, lerp, pali, parel, pia, Ra, Rae, rale, Rea, rei, rep, rial, be omitted and the test scored on a basis

³ WHIPPLE, G. M. *Manual of Mental and Physical Tests*, II, p. 642.

of 50 words, the calculation would be facilitated and grading might be fairer.

The highest score in the Ink Blot test was 23, so for convenience it was assumed that 25 would be the highest number and all the results were multiplied by 4. It had been planned to give some tests in puzzles and logical arguments, but the time did not permit these being tried. The averages on a scale of 100 for the different percentiles are given in Table III.

The average age of the freshman class was 18.19 years. Their average in the Marble Statue 36.2, as seen by Table III, is below Pyle's 18-year norm, 37.8, though their median and mode is 37. If arranged according to rank from highest to lowest as to general average and as to scores in the Marble Statue, the 17 who obtain the highest average get a lower rank in the reproduction of the story, and of the 30 whose class standing is highest, only one has a higher rank in the Marble Statue. On the other hand, of the lowest 30 in class rank 24 have a higher rank in the Marble Statue. Perhaps there is here an indication that the poorer students are more accustomed to verbatim repetition and therefore make better scores than do some better students who habitually try to get the gist in their own thought-terms. The fact that only two whose class rank places them in the highest quartile are among the lowest 25% in the Marble Statue and only 2 whose grades are among the lowest fourth are among the highest fourth in reproduction, shows that the accuracy and degree of retention must correspond somewhat closely to ability in college work, though, as was intimated above, other factors, especially capacity for verbatim repetition, make the results of the test variable.

The scores in the Part-Whole test as compared with Pyle's norms are a little lower, the mean being 19 as against 19.7, though the median for our freshmen is 20. Since the Woodworth-Wells series was used, the difference in the words may account somewhat for the slight difference in scores. That over 50% of the students make perfect scores, but that of these 52 not more than 8 are among the lowest fourth in class rank, indicates that there is a certain correspondence between speed and accuracy of association and class standing that may not be evident from the correlation coefficients.

The score for the Genus-Species test is exactly Pyle's male norm, and therefore lower than his female norm. Here again the difference in words must be taken into account, and also that the

median is 19. In this test 11 of the students in the lowest quartile as to grades are among those who make perfect scores, and also 7 of the highest quartile, a fact indicative of the variability which is illustrated by the varying correlation coefficients of this test with the freshman class grades. The average of these three tests, the Opposites, Part-Whole, Genus-Species, when correlated with the average of the class standings of the freshmen, gives a coefficient $r = .03$.

All the results of the substitution test (substitution IV) refer to blank IV of Mrs. Woolley's⁴ substitution test. The percentile scores of our freshmen vary so widely from Mrs. Woolley's⁵ accuracy scores that any definite comparison seems impossible. The percentile scores for 14-year-old working girls are 84.7, 95.9, 98.5 and for 15-year-old girls 89.1, 97.2, 98.8 as compared with 37.4, 64.4, 86.8 for our college freshmen. The difference must in part be due to the short time limit. It is a curious fact that 25% of these college freshmen get a score of 100% and still the 75 percentile score is barely above the 25 percentile score of Mrs. Woolley's 14-year-old working girls and below that of the 15-year-old girls. In contrast to the working children who in some cases "were more correct in the latter part of the page than in the beginning"⁶ these college girls made the same mistakes throughout if some figure was incorrectly filled. Eight of the highest quartile in class grades, and 7 of the poorest also are among those who made perfect scores in Substitution IV, 7 of the poorest in the test are also lowest in college grades, 4 of the best students are among the lowest 25% in the test. Speed and accuracy in this form of learning evidently involve a number of factors, as is also evidenced by varying correlation coefficients in Table III.

Since in the cancellation test only A's were crossed out, the results given in Table III can be strictly compared only to Mrs. Woolley's⁷ scores for fourteen-year-old girls. The divergence of the two sets of results is here even more marked than in the substitution test. Mrs. Woolley's percentile scores are 70.7, 81.6, 90.3 as compared with 39.2, 47.8, 55.6, the corresponding scores

⁴ WOOLLEY, H. T., AND FISCHER, C. K. *Mental and Physical Measurements of Working Children*. Pp. 148-156.

⁵ *ibid.* P. 152.

⁶ *ibid.* P. 150.

⁷ *ibid.* P. 110.

of the college girls. Not a single student made a perfect score and the lowest score for the college girls is 22 as compared with 30.8 for the working girls. So the time was evidently too short, and 2 minutes at least are needed for this test. The difference between the three percentiles is also greater for the fourteen-year-old working girls than in the case of the college girls.

In the opposites test the college girls are as decidedly superior to the working girls^s as they are inferior in the two previous tests. The 75 percentile score of the 15-year-old working girls is just about equal to the 25 percentile score of the college girls, as can be seen from the freshmen scores 90, 97, 99.3 as compared with 71.2, 80, 88.9 for the working girls. About 42% of the freshmen make a perfect score in this test, 11 of these 42 being among the students in the highest quartile and 9 in the lowest quartile according to class standing. Of the lowest 25% in the test, only 3 are among the poorest quartile, but 5 are among the highest quartile according to grades. Such relation of good and poor students to this test is also shown by the low correlations with the college subjects, the highest coefficient being .22 with psychology, which includes only 30 students.

In the Word-Building test the college girls get a mean of 18 words as compared with Pyle's norm of 19.6 for 18-year-old girls, though the time limit was the same. If the Word-Building test is scored on the basis of 50 words as the 100% standard, the ascending percentile scores will be 19.6, 28, 30, 33.2, 35.5, 36, 38, 41.6 and 44.8 and the 25 percentile, 24.8, the 50 percentile 33, and the 75 percentile 37.6. The lowest score is 6 and the highest 66. The distribution on both sides of the median is very regular. If the test were scored on the basis of 50 words and the time limit increased to 7 minutes, it might prove to be a better test for quickness of association as well as of ingenuity than some of the association tests which prove too easy for 70% of the students when given as group tests.

The Ink Blot test seems least suited of all these tests for group work, as it is difficult to see them even at a short distance. Pyles' norms are not given for girls beyond 13 years. At this age his norm is 10.3. For these 23 college girls who were able to see the blots, the mean is 14, and the median 12 blots; the lowest score is 10 and the highest 23.

^s *ibid.* P. 221.

TABLE III.
Grades, Tests and Correlations

	Average	English	For. Languages	Mathematics	History	Psychology	Substitution IV.	Genus Species	Marble Statue	Part-Whole	Cancellation	Opposites	Word Building	Ink Blots
No.....	99	94	54	46	42	30	99	99	97	97	99	99	48	23
Worst....	58	53	53	52	65	55	18	50	20	45	22	77.5	3.9	40
10%.....	71.6	65	67.8	60	69.5	60	27.6	58	34	70.5	36	85.7	12.9	40
20%.....	76.8	72.7	74.8	67.2	72.7	69	41.4	74	43.8	89.5	40.6	92	18.4	40
30%.....	78.5	74.4	77.8	70.8	74	72	51	81	47.9	95	43.8	95.5	19.7	40
40%.....	79.9	76.3	80	72	75.2	73.6	61.6	85	51.9	95	47.2	97.5	21.8	40
50%.....	81.2	78.8	82	74.8	76.5	78.6	73.4	90	54.9	97.5	50.2	97.5	23.2	48
60%.....	83.2	80.6	82.8	77.8	78	80.3	79	95	57.3	100	52.6	98.25	23.6	56
70%.....	84.8	82.5	85.1	82.8	80.5	83.6	90	99.5	59.5	100	56.8	100	25	68
80%.....	85.9	85.2	87.5	88.4	83	86.6	98.4	100	62.2	100	62.2	100	27.3	72
90%.....	88	87.2	89.1	92.8	86	88.3	100	100	65.8	100	69.4	100	29.4	76
Best.....	94	92	95	95	90	95	100	100	76	100	92	100	43.3	81.2
25%.....	74.4	69.7	71.1	64.1	70.7	65.4	37.4	68.8	40.5	83	39.2	90	16.3	40
50%.....	80.1	76.3	80	72.3	75.8	75.7	64.4	86.4	52.3	96	47.8	97	21.5	44.8
75%.....	84.1	81.1	84.2	78.9	80.5	82.4	86.6	97.8	58.9	100	55.6	99.3	24.7	62.4

	Substitution I, II, III.	Substitution IV.	Genus Species	Marble Statue	Part-Whole	Cancellation	Opposites	Word Building	Ink Blots	Information (Senior)	Information (Freshman)
No. of Students.....	99	99	99	97	97	99	99	48	23		
Highest score.....	100	100	100	76	100	92	100	43.4	81.2		
Lowest score.....	18.6	18	50	20	45	22	77.5	3.9	40		
Mean.....	86.8	72	86.5	54	95	54	96.5	23.6	56	41.8	39
Median.....	94.6	78	90	55	100	52	97.5	23.6	48	48.56	44.5
Mode.....	100	100	100	55	100	40.52	100	23.6	40		

Subjects	No.	Mean	Median	Mode	Substitution IV.	Genus Species	Marble Statue	Part-Whole	Cancellation	Opposites	Word Building	Ink Blots	Opposites, Part-Whole & Genus Species
For. Lang.....	54	83	82	88.81	—	.03	—	.14	.31	.20	.01		
Math.....	46	74	75	71	0	.19	.16	.32	.19	.05			
Hist.....	42	80	77	74	.13	0	0	0	.06	.01			
English.....	94	79	79	86.74	.23	.06	.38	.29	.57	.14			
Psychol.....	30	78	80	80	.48	.26	.43	.32	.05	.26			
Class Av.....	99	81	82	85.80	.16	0	.20	.25	.11	.08	.23	.23	.03

	For. Lang.	Math.	Hist.	English	Psychol.
For. Lang.....		.48	— .99	0	
Math.....	.48		.56	.38	
Hist.....	— .99	.56		.29	
English.....	0	.38	.29		.75
Psychol.....				.75	
Class Av.					

The percentile table shows the striking differences between the class standings and test scores. In none of their class averages do these students get as low nor as high marks as in the tests. As a matter of fact, a few of these freshmen failed utterly in some of their college subjects, but as they did not take a final examination their grades were not given on the college register and could, therefore, not be used. If these had been put down, the lowest scores would probably have been very similar. The percentile averages in foreign languages agree best with the general averages. English, mathematics and psychology give very similar distributions of the percentile averages, while the standings in history are higher at the lower and lower at the higher end than the grades in other subjects.

The substitution test is the only one that is somewhat comparable with the class standings, especially in history, mathematics, English and psychology, but only in the percentiles just above and below the median. If the actual scores are disregarded the distribution of percentile averages is somewhat similar in mathematics and cancellation, in psychology and Marble Statue.

The correlations of these tests with the general class averages range from 0 to .25, being in ascending order, Genus-Species 0, Opposites .08, Cancellation .11, Substitution .16, Marble Statue .20, Word-building and Ink Blots .23, and Part-Whole .25. The only negative correlations are found between foreign languages and Marble Statue (— .14). History shows very slight positive correlation with any of the tests, the coefficients being 0 in Genus-Species, Part-Whole and Marble Statue and the highest .13 with the Substitution test. In ascending order of positive correlation with the six tests, the college subjects range as follows: History, foreign languages, mathematics, English and psychology.

In comparison with Waugh's⁹ coefficients of correlation, these college girls give much lower coefficients than the Beloit students,

⁹ BELL, J. CARLETON. *Mental Tests and College Freshmen*. Jour. Educ. Psychol. VII, 7, p. 382.

.08 as compared with .54 for Opposites, .16 as against .24 in the Substitution test, and .20 as compared with .40 for Retention of Ideas (Marble Statue). Of the tests used by Bell¹⁰ for the Texas University freshmen, the only one at all comparable with the Newcomb College tests is the Triangles, which is a cancellation test. Except at the lowest end the percentile scores of the Texas freshmen in the Triangles test are higher than those of the Newcomb freshmen in their cancellation test. The Texas students, however, show much lower correlation coefficients for this test with their college subjects, the difference being especially noticeable in English, where the coefficient of the Texas freshmen is .01 and of the Newcomb girls .57.

These 99 freshmen may also be classified according to courses, into 47 B.A. students, 34 Education and 18 Art and Music students. In the color triangle test 90% of the B.A. group, 70% of the Education group and 72% of the Art and Music group give objective judgments. On the other hand, 11% of the Education students, 11% of the Art and Music students and only 6% of the B.A. students give associative judgments, while 2% of the B.A. students, 9% of the Education and 5% of the Art and Music girls belong among the objective-physiological type. Though the number of the students giving judgments of the two latter types are few, it is significant that students in Education and in Art and Music should agree better with each other in their aesthetic judgments than either of them with the B.A. group.

In contrast to this grouping, Table IV shows very different interrelations between the three groups in respect to the means and medians of the other tests and the correlation of these tests with the general class average.

In five tests the Art and Music students have a higher mean than the other two groups. The one exception is the Marble Statue in which the Education division make a better average, though their class average is below that of the B.A. and the Art and Music students. The Education students alone get uniform positive correlations between the tests and their class average, and the Art and Music group get negative correlations with the exception of the Genus-Species test where the coefficient is

¹⁰ *ibid.* Pp. 381-399.

TABLE IV
Scores of Student Groups

	Subst.		Genus-Sp.		M. Stat.		Wh.-Part		Cancell.		Opposites		Average	
	Mean	A. D.	Mean	A. D.	Mean	A. D.	Mean	A. D.	Mean	A. D.	Mean	A. D.	Mean	A. D.
B. A.	70.0	9.8	89.0	2.02	53.7	5.7	95.2	1.0	55.4	5.5	95.75	1.6	82.1	4.6
Educ.	72.2	12.3	84.5	2.3	56.3	4.8	93.5	1.5	51.4	4.8	95.25	1.5	79.8	5.0
Art and Music...	76.0	8.5	91.5	1.1	54.4	5.5	95.25	.94	59.0	5.3	98.25	.88	81.5	3.55
	Median		Median		Median		Median		Median		Median		Median	
B. A.	76		95		55.2		95		52		97.5		82	
Educ.	78		85		55.2		100		50		97.5		83	
Art and Music...	80		100		58.2		100		48		100		81	

Corr. with
Class Av.

	Subst.	Genus-Sp.	M. Stat.	Wh.-Part	Cancell.	Opposites	Eng.
B. A.	-.05	-.08	.08	.37	.20	.11	.71
Educ. ....	.48	.06	.40	.35	.05	.34	.73
Art and Music...	-.16	.19	-.64	-.22	-.03	-.19	.80

positive. The B.A. students are the most variable in regard to these correlations. The higher and closer correlation coefficients of the average with English are in conspicuous contrast to the other coefficients.

If compared with the mean of the whole freshman group, the B.A. students have a mean in the Opposites and Substitution tests below the general mean, and the Education students are below the freshman mean in the Genus-Species, Part-Whole, Cancellation and slightly in the Opposites tests. Their grade average is also lower than the class average. The Art and Music students are above the freshman mean both in the tests and class grades. As measured by the freshman medians the B.A. students have lower medians in the Substitution and Part-Whole tests and the medians coincide in Cancellation, Opposites and grade average. The Education students score lower in the Genus-Species and Cancellation and coincide with the general median in Opposites. The Art and Music students fall below in Cancellation and Average. It seems to follow from these facts that the B.A. students are inferior in the Substitution test, Education students in Genus-Species and Cancellation, and that the Art and Music group get fewer low scores than either of the other two groups whether reckoned according to the mean or the median.

There were eight freshmen who obtained an average of 90 or above in class standing and there were also eight who were below 75. Table V shows the scores of these sixteen students:

TABLE V.
Class Standing of Poorest and Best Students
POOREST STUDENTS

Student	Average	English	Foreign Lang.	Math.	Hist.	Psychology	Information	Opposites	Cancellation	Genus Species	Part Whole	Building Word	Marble Statue	Ink Blots	Subst. IV
75....	58	72			73			97.5	85	100	95	18	65		50
67....	67	71						100	61	60	100		38		34
5....	69	71	53	60	74			97.5	68	100	100		60	52	100
1....	70	64				55		90.5	58	100	95	22	37		100
20....	72	74	71	52	65		52	100	70	70	80		20		76
58....	73	65				67		97.5	44	95	95		55		96
44....	73	53			76			80	50	55	75	26	53		32
79....	74	66	84	77	80			100	42	100	95	22	60		98
	69.5	67	69.3	63	73.6	61		95.3	59.7	85	91.8	22	48.5		73.2

BEST STUDENTS

39....	94	90				95		100	70	100	100	25	73		100
54....	93	92	90	94				97.5	68	100	100		64		80
30....	91	90	89				74	97.5	58	80	100		49		80
99....	91	87			78		33	100	42	100	100		59		24
16....	90	83	90	95	90			97.5	52	100	95	23	61		100
19....	90	82						100	50	75	75		55		68
21....	90	86	94	93	90		58	100	48	80	100		53		80
26....	90	86	89	95	90			100	50	95	100	19	47		44
	91.1	87	90.4	93	87		55	99.06	54.7	91.2	96.2	22.3	50.1		72

It is evident that the poorer students have a lower average in Opposites, Part-Whole and Genus-Species, most decidedly in the latter; that they differ very little from the better students in the Marble Statue and Substitution tests, and that the scores and the average in the Cancellation test are in their favor. Those who obtain the highest class standings are apparently superior in speed and accuracy of association, but in work which tests accuracy and speed of discrimination and of learning, there is besides the variability due to the complexity of the processes, probably also a conflict between quickness and accuracy. In the Marble Statue we find that scoring on the basis of the number of ideas as given by Pyle gives the better grade students somewhat higher standings. If the reproductions are marked more on a qualitative basis, that is, on ability to grasp main points

and to organize details accurately and logically, the best students seem more decidedly superior in this test.

CONCLUSIONS

1. Group testing of college students is feasible and an economy of time especially in measuring speed and accuracy of association and memory and in certain types of learning and reasoning. Measurement of motor ability can then be made individually in a brief time.

2. Of the standard tests outlined above the Cancellation, Substitution, Marble Statue and Word-Building seem most suitable and valuable for group testing. The three tests in speed of association, the Genus-Species, Part-Whole and Opposites seemed too easy for the great majority of the students and may become mainly tests in speed of writing if the time limit is shortened. Of the latter three the Opposites seems of most worth, as it may be made a measure of accuracy as well as speed of association and may be an index to a certain type of mental maturity, if the results are compared with the scores of immature children and those whose school career is limited, as Mrs. Woolley's working girls.

3. At least two trials of association and memory tests are needed to avoid results that in the one case are affected by some momentary inability to get the right word, and in the other, may be a measure of immediate repetition rather than of organized retention. In memory tests both a quantitative and qualitative basis of calculating results seems advisable.

4. Although many factors render the Information test inaccurate, still its value in giving sidelights on a student's interests and his understanding of terms, in common use but vaguely defined, seems great. It also stimulates inquiry and a search for more definite knowledge on the part of the students. If the questions could be frequently changed or half of them replaced by terms relating to the current events of each year, it might serve several useful purposes. The higher correlations of this test with the Senior subjects than with the Freshman may be due in part to the practice of giving courses relating to present-day life as Junior and Senior electives.

5. Aesthetic tests ought to be used in addition to those commonly used to reveal both the different types of aesthetic judg-

ment and the student's tastes. Such a test as the color triangles serve the purpose as an introductory test in aesthetic analysis. The classification into the four types used by Bullough and Valentine is not satisfactory, and therefore there is still more need of wider use of such tests. In the experiments of Bullough and Valentine the women tested gave a preponderance of the associative judgments. Among the freshmen tested only 12% gave associations as basis for some of their estimates, and in only one case did the associative judgments preponderate over the other types. Our results show a very great preponderance of objective judgments, though as has already been stated, these might be resolved into different types of judgments after more careful analysis on the part of the students.

6. The correlation coefficients are more variable for the college subjects correlated with each other than with the tests. The coefficients in the former case vary from $-.99$ between history and foreign languages to $.75$ between English and psychology, and in the latter from $-.14$ between foreign language and the Marble Statue to $.57$ between English and Cancellation. (Table III.) It may be worth while to remark incidentally that the correlations of subjects with each other might well be considered in grouping together major and minor courses.

7. Tests such as those tried in this experiment may be a valuable aid in vocational guidance. The very fact that the scores of the students in these tests vary so widely from their class standings gives the examiner a better insight into their capacities. If the scores of college students (1) in physical examination, (2) in college subjects and college activities, (3) in tests of their ability in reasoning, association, memory, speed and accuracy of learning, and of their interests and tastes be all combined, the resultant ought to be a fair index of their vocational capacities.

ECHOLALIA IN IDIOTS: ITS MEANING FOR MODERN THEORIES OF IMITATION

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In recent years much light has been cast upon normal psychology through the interest bestowed upon abnormal minds. The insane and neurotic have been studied from the standpoint of instinct and volition by Janet, by the Freudians, and by Adler and his disciples, but in the case of aments (mental defectives) the new knowledge gleaned has related largely to the cognitive processes. The affective and volitional life of aments has not been systematically observed and described. I wish to present in this paper three cases of echolalia occurring in idiots, with a view to ascertaining, if may be, what, if any, light this phenomenon may cast upon modern controversies about the nature of imitation in man.

For the benefit of those who have made no special study of pathological psychology, and who are therefore not completely oriented in this special field, it may be stated that echolalia is an interesting tendency found in aments and in certain insane patients, to *repeat* or *echo* automatically whatever is said to them or in their hearing. Barr¹ defines echolalia as follows: "We find echolalia a rare form of aphasia, betokening always a marked mental impairment, and therefore most naturally associated with other forms of degeneration. There being no record of the autopsy of such a case, the precise lesion, if there is one, remains yet to be demonstrated.

"In the act and in the echo he (the patient) is simply a creature of suggestion. His capacity for receiving such suggestions so rapidly as to echo these instantaneously, without thought, would tend to show less impairment of the sensory than of the motor centers, and therefore confirms my impression that the defect, not so much sensory as motor, is to be defined as transcortical aphasia."

Pick² has called attention to the occurrence of echolalia in aphasia patients, and regards the manifestation in these cases

¹ BARR, M. W. *Mental Defectives*. P. Blakiston's Son & Co., Phila., 1913 ed.

² PICK, A. *Zur Frage nach der Natur der Echolalie*. Fortschritte der Psychologie. Jan. 4, 1916, Heft 1, Bd. IV.

as dependent on a conditioned reflex. "Für niemanden, der auch nur einmal an einem Aphasischen jene Form der Echolalie beobachten konnte, die Wir ihres Tempos wegen als die 'auf Anhieb' bezeichnen, kann es zweifelhaft sein, dass es sich dabei um die Auslösung eines Vorganges handelt, der sich als einem Reflexe gleich darstellt.—Dementsprechend bin ich seit langem dafür eingetreten, dass es sich bei der Echolalie auf Anhieb um das Funktionieren eines in der Norm gehemmten, in der Krankheit von den Hemmungen befreiten, Mechanismus handle." In at least one of the cases cited by Pick the mental condition of the patient, an old man, eventually cleared, whereupon the echolalia ceased along with the other symptoms.

Barr,³ Lichtheim,⁴ and Bastian⁵ have attempted to explain the probable neurological basis of echolalia and of the similar condition, echopraxia (which is the tendency to repeat movements made by others), but the neurological aspects of the matter do not chiefly concern us here. In describing the phenomenon Bastian says: "It sometimes happens that the speech of patients is entirely limited to a mere imitative repetition of words spoken in their hearing, while they are without the power of volunteering any statement; that is, their auditory word centers respond only to direct incitations, and not at all to those of an associated or volitional order. In these cases (usually included under the term echolalia) a marked general impairment almost invariably co-exists."

Echolalia has been confused in the minds of some authors with other conditions which only remotely resemble it, such as coprolalia (the tendency to repeat spontaneously certain obscene or profane words or phrases). Thus Mills⁶ confuses echolalia with morbid impulses in general. The term echolalia should properly be confined, for the sake of clearness, to that condition in which the patient repeats or *echoes* what he has just heard, with relatively little power of originating or of spontaneously uttering remarks of his own.

That echolalia has not been discussed more fully in the literature of pathological psychology is doubtless due to the infre-

³ BARR, M. W. *Op. cit.*

⁴ LICHTHEIM. *Brain*. Vol. VII. (Cited by Barr.)

⁵ BASTIAN, H. C. *Aphasia and Other Speech Defects*. D. Appleton and Co., New York, 1898.

⁶ MILLS. *Am. Text Book of Diseases of Children*. P. 663. (Cited by Barr.)

quency of its occurrence. The term echolalia was first used by Romberg, and the condition was for some time described only in connection with coprolalia or with palmus (tic). Noir⁷ in 1893 asserted that he had found echolalia occurring without any tendency either to coprolalia or palmus. Since that time Langdon Gray,⁷ Barr⁷ and others have described cases of pure echolalia occurring in aments. As to the frequency of its occurrence, Beach⁷ and Shuttleworth⁷ report that there are only a few cases to be found in their large institutions. R. L. Down⁷ reports it in about 4% of the aments under his care. Barr⁷ in a personal examination of 2500 mentally defective children is able to report two cases of what might be called true echolalia. In the personal examination of about 5000 cases of amentia, I have seen three clear cases of echolalia, one occurring singly; one occurring in connection with echopraxia; and one occurring in connection with a motor automatism. These cases⁸ were as follows:

CASE NO. I. E. D. Female. Aged 5 years. American born of Jewish parents. Brought for mental examination because she did not behave as other children behave, and was stupid. The patient did not walk till she was three years old, and did not talk till she was a little older. When finally she began to speak, she *echoed* what she heard, not volunteering or originating any remarks of her own. When questioned, she merely repeated the question, apparently without any idea that a response was expected from her. The mother, having no insight into the true condition, had been accustomed to punish the child severely, on the supposition that she was "just fresh," and that the echoing of the words of her elders resulted from an incorrigible impudence. Such discipline was attempted by the mother in the clinic, during the course of the examination.

When tested by means of the Binet and other mental tests, no *response* whatever was elicited from the child. She echoed automatically and immediately all the questions put to her, but showed no understanding of the question-response situation. Her pronunciation of the words echoed was quite distinct. Her attitude was docile and friendly throughout. She simply sat on the chair, and echoed whatever was said to her. For example, the conversation ran somewhat as follows:

Q. "Are you a little girl or a little boy?"

A. "Are you a little girl of a little boy?"

Q. "What is this?"

A. "What is this?"

Q. "No, no, baby! You *answer* what I say."

A. "No, no, baby. You *answer* what I say."

None of the mental tests was successfully passed, except such as involve the repetition of words or numbers.

No tics or spasmodic movements accompanied the echolalia. The questions were simply *repeated* instead of being *answered*. The mother stated that this had been the case from the time the child first began to utter words. There was no response at all to copying tests or construction tests. She was unclean in her habits, and showed no power of responding to tests of intelligence. Her case was rated as one of idiocy, bordering on low grade imbecility.

⁷ See BARR, M. W. *Op. cit.*

⁸ These cases were observed by the writer while engaged as Clinical Psychologist in the Department of Public Charities of New York City, and at Bellevue Hospital.

CASE NO. II. M..... M..... Female. Aged 11 years. Born in America of Irish parents. Brought for mental examination by the, a society for the care and protection of children. Both her father and mother were said to be under treatment in the alcoholic wards at Bellevue. This patient echoed both words and movements. She imitated exactly even the tones and inflections of the examiner's voice. The echo was automatic and inevitable. She echoed not only words addressed to her, but also what was said by others in the room. No response whatever could be elicited from her, other than a reproduction of what was said or done by the person attracting her attention. In this way she performed copying tests, and tests involving the repetition of sounds. Her ability to reproduce words and tones was astonishingly good, but her reproduction of movements was not precise. She was afflicted with chorea, and though she would take the pen or pencil and try to copy a square or diamond, just as she had seen the examiner do, the result was not identical with that achieved by the examiner. She was entirely lacking in ability to adapt herself independently to even the simplest situations, and her actual intelligence was not above the grade of idiocy.

No developmental history could be obtained in the absence of both of the parents.

CASE NO. III. Unknown man. Aged about 30 years. Brought in from the streets. He was found by the police, wandering about, and when questioned gave no answers, but instead repeated what was said to him. Accordingly he was sent to the hospital for examination. This patient, when questioned, merely echoed, as best he could, the words said to him. His response was mechanical, and was accompanied by a peculiar automatism. As he began to articulate, his right hand would fly up to his left shoulder and execute two sharp, successive slaps; then fall back to its normal position again.

The patient could obey simple commands, such as "sit down," "stand up, now," etc., but he showed no power of adapting himself to situations and commands beyond this. The neurological and psychiatric examination failed to establish a psychosis, and a diagnosis of idiocy was made. No history of any kind could be elicited.

Recently Prof. Thorndike⁹ has called into question the use of the word "imitation," and has clarified thought by raising to the consciousness of his readers the lack of precision with which the word has hitherto been used. Prof. Thorndike states his position thus:

"It is better—instead of asking vaguely whether imitation of other men is an original tendency in man, to put separately the following questions:

"A1—Do the sense presentations (chiefly through sight) of all movements as made by another, produce in man, apart from all training, *identical* movements?

"A2—*Similar* movements?

"A3—*Tendencies to make similar* movements?

"A4—If some, but not all, movements have this power, which are they?

"B1—Do the sense-presentations of all positions of the body taken by another, all sounds made, all facial expressions

⁹ THORNDIKE, E. L. *The Original Nature of Man*. Teachers College, Columbia University, 1913.

assumed, and other results of movement upon the mover's body, produce in man, apart from all training, movements resulting in *identical* positions, sounds and looks?

"B2—*Similar* ones?

"B3—*Tendencies to make movements*, resulting in similar or identical ones?

"B4—If some, but not all, positions, sounds, looks and the like have this power, which are they?"

Prof. Thorndike's contention is that "The direct potency of behavior in creating something like it in another human being's behavior is not discoverable in any series of experiments in which the effects of the laws of exercise and effect are precluded or allowed for"; also that "the same absence of evidence of any general original production of similar behavior by behavior witnessed, holds good for sounds as well. . . . No one can believe that *all* of a child's speech is acquired by direct imitation. On many occasions the process is undoubtedly one of the production of many sounds, irrespective of the model given, and the selection of the best one by parental reward."

Prof. Thorndike judges, therefore, that "the original attentiveness of man to the acts, movements, positions, sounds and facial expressions of other men, and the original satisfyingness of the approval so often got by doing what other men do,—are really the tendencies or predispositions or potentialities that do the work in question."

After critical discussion of the use of "imitation" by such social psychologists as Tarde and McDougal, Prof. Thorndike concludes: "On the whole, the imitative tendencies, which pervade human life, and which are among the most powerful forces with which and against which education and social reform work, are, for the most part, not original tendencies to respond to behavior seen by duplicating it in the same mechanical way that one responds to light by contracting the pupil, but must be explained as the results of the arousal, by the behavior of other men, of either special instinctive responses or ideas and impulses, which have formed in the course of experience, connections with that sort of behavior. Man has a few specialized original tendencies, whose responses are for him to do whatever the man forming the situation does. His other tendencies are habits learned nowise differently from other habits."

The few specialized original tendencies to respond by doing what the man forming the situation does are, "smiling when smiled at, laughing when others laugh, yelling when others yell, looking at what others observe, listening when others listen, running with or after people who are running in the same direction, running from the focus whence others scatter, jabbering when others jabber and becoming silent when they become silent, crouching when others crouch, chasing, attacking and rending what others hunt, and seizing whatever object another seizes."

To Prof. Thorndike's discussion and final conclusion Prof. Montague¹⁰ has made persuasive objection, on the ground that the former has drawn a false analogy between sympathetic magic and the theory that given behavior tends to produce similar behavior in witnessing human beings. Prof. Montague declares that Prof. Thorndike overlooks the presence of a sensitive medium of communication, which exists in the case of ideomotor activity, *i. e.*, the nervous system; whereas in the case of sympathetic magic no medium of communication or transmission exists. Herein, according to Prof. Montague, lies the failure of the analogy. It is pointed out that such an imitative tendency as yawning when others yawn can scarcely be said to have survival value from either the biological or social standpoint; that, moreover, though response to *elements* in imitated situations may have been either inherited or learned by trial and error, so that habit would account for the imitation, nevertheless it is the *tout ensemble* of the situation, not the separate elements, which is important, and this is often absolutely novel.

The nature of imitation, and the propriety of its inclusion among the instinctive tendencies of man, is thus a controverted question. Does the behavior of our idiots furnish any new light to the controversy? We appear to have in Case No. II an instance in which "sense-presentations of all movements as made by another, produced in an individual, apart from all training, tendencies to make similar movements," and also in which "all sounds made produced in the individual attending, similar sounds." This child was an idiot, without the power of originating spontaneous remarks. She had not the intelligence to learn to perform even the simplest acts independently. It would

¹⁰ MONTAGUE, W. P. *Prof. Thorndike's Attack on the Ideo-Motor Theory*. Journ. of Phil., Psych. and Sci. Meth., 1914.

seem that in such a case we do have an original tendency to respond to behavior perceived, "by duplicating it in the same mechanical way that one responds to light by contracting the pupils."

In Case No. I we have the reproduction of sounds, made apparently quite automatically, "in response to sense-presentations, apart from all training." This child also was an idiot, bordering on low grade imbecility. She had not even sufficient intelligence to respond independently to the simplest situations, such as replacing the blocks in the Vineland Form Board. Surely it could not be argued that her reproduction of questions put and of statements uttered had been learned because of the satisfyingness of parental approval, for she had been severely punished for the "echoing," and yet was unable to learn by pain to inhibit it. She got nothing but social disapproval for her reaction, yet she made the same reaction mechanically and inevitably.

In Case No. III we have an adult who persisted with mechanical certainty in performing an act of imitation which was socially the least useful act conceivable. Here also sense-presentations produced in a human being tendencies to make similar sense-presentations, apart from all training. In the case of Barr's imbecile it was found by experiment that he could reproduce with facility words uttered in his hearing in nine different languages, with which he was totally unfamiliar.

The echoing of Pick's aphasia patients also presents problems of interest for the student of imitation. These questions naturally arise: Does the echoing of such patients result from an organic lesion? Or is it functional in character? Is it *related* psychologically to the echoing of idiots? Is it, perhaps, *identical* in its nature with the phenomenon observed in idiots? The aphasia patients had formerly acquired, at a time when they were of normal intellectual status, the knowledge of the use and meaning of words. Hence their echoing of words may not be said to have taken place "apart from all training." Furthermore, these patients may "clear up," and return to normal again, then ceasing to echo. The idiots, on the other hand, never have been and never will be "teachable."

It is unfortunate that so very little is known about the three cases here presented. It would be scientifically desirable to have known each one from birth, and to have observed the very begin-

nings of this phenomenon. It would also be desirable to observe them over long periods, and to try various pedagogical devices on them, to determine, if possible, the modifiability of the tendency to echo. Since it occurs so rarely, it is probable that a long time will elapse before any detailed and careful study of echolalia in idiots can be made from the psychological point of view. In the meantime it is difficult to see how the reaction of these extreme cases is to be explained except on the ground of an original tendency to ideo-motor activity. And if we so explain it, are these persons to be regarded as suffering from some lesion which sets them apart as an absolutely separate species? Or do they merely show, in an extreme form, an instinct that exists as an element in the original nature of man, and is distributed according to the curve of probability?

THE MENTALITY OF THE DEPENDENT CHILD, TOGETHER WITH A PLAN FOR A MENTAL SURVEY OF AN INSTITUTION

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The mentality of the delinquent child has received a considerable amount of attention and we have at the present time a great number of books and articles dealing entirely or in part with this problem. Relatively little, however, has been written about the mentality of the dependent child. The reason for this is obvious, because the delinquent child challenges the attention of the social worker and his delinquency demands an explanation. The delinquent is in one sense a more serious problem than the dependent. Nevertheless, the dependent child, while not occupying so dramatic a position as the delinquent, presents a very difficult problem to society, and one of the factors that will help us solve the problem of the dependent is a little better knowledge of the mental make-up of this class of children. An examination of the mentality of this class becomes more urgent from the practical sociological point of view, the more we insist upon the best methods of dealing with these children. The right of the child to a home and to all that goes with a home, which an institution cannot give, may be called a modern conception of our duty to the dependent child. This has given rise to the placing of children in homes either for temporary care or for permanent adoption. "Child-placing," as a means of caring for dependent children, is practised on a much larger scale today than it ever has been. To carry out such a scheme satisfactorily, we must know a great many things about the home in which the child is to be placed and we ought also to know as much about the child as possible to make sure he will fit into his new environment.

It is not our purpose to deal with all the factors that should determine the right home for the right child. We shall only deal with one factor, the mentality of the child. No subnormal child should be placed in a complex environment and be expected to succeed; no feeble-minded child should be given to unsuspecting parents for adoption. It will be readily seen that child-placing agencies assume a great responsibility in the placing

out of children, and this responsibility is recognized by the best of such agencies in their insistence upon a thorough mental examination of each of their wards before they are placed out in homes.

The literature dealing with the mentality of the dependent child, as far as the writer can discover, is very scanty. A recent work of Stenquist, Thorndike and Trabue¹ showed the results of tests of dependent children as compared with public school children, and in general the dependents fell below the other children in mentality. Hall² reported tests in the orphan asylums of New York State and found on the whole that this class of children was somewhat inferior to the public school children that were tested with the same tests for comparative purposes. Streeter³ gives a summary of the children tested in the orphanages in New Hampshire. The Binet Scale was used. The distribution of 1248 children shows 49 per cent. normal, 30 per cent. backward, and 21 per cent. feeble-minded. This seems an abnormally high percentage of feeble-minded, and approaches the customary percentages of feeble-minded among delinquents. Pintner⁴ in comparing delinquents and dependents at the juvenile court found a much larger percentage of feeble-minded among the delinquents than among the dependents. He says, "The chief characteristic of this group of dependent children is their backwardness."

The present investigation deals with two groups of dependent children: (1) Eighty-two children tested by the writer for the Ohio State Board of Charities; these were cases which for various reasons had come under the immediate care of the Board; (2) 106 children forming the total population of a county children's home, with the exception of children below age six. We shall first give a brief discussion of the results of the tests of these two groups from the point of view of the percentage of feeble-minded among dependents, and then a more detailed discussion

¹ STENQUIST, J. L., THORNDIKE, E. L., and TRABUE, M. R. *The Intellectual Status of Children Who Are Public Charges*. Archives of Psychology, No. 33, September, 1915.

² New York State Board of Charities. *Eleven Mental Tests Standardized*. Eugenics and Social Welfare Bulletin, No. V.

³ STREETER, L. C. *Existing Conditions Relating to Defectives and Feeble-mindedness in New Hampshire*. Report of New Hampshire Childrens' Commission, 1916.

⁴ PINTNER, R. *One Hundred Juvenile Delinquents Tested by the Binet Scale*. Pedagogical Seminary, Vol. XXI, No. 4, December, 1914, pp. 523-531.

of the tests conducted at the children's home from the point of view of the best method of making a mental survey of an institution.

Feeble-Mindedness Among Dependents

(1) *State Charity Cases.* The eighty-two state charity cases were sent to the writer for mental examination from time to time during the past three years. The first 56 cases were tested by the Binet Scale, and the last 26 by the Yerkes-Bridges Point Scale. The diagnosis of the first 56 on the Binet Scale is as follows:

	No.	%
Normal.....	21	37.5
Backward.....	19	34.0
Feeble-minded.....	12	21.4
Doubtful.....	4	7.1
Total.....	56	100.0

The percentage of feeble-minded here is high and this, we believe, is owing to the rather select group of cases with which the State Board has to deal. There seems to be a tendency to refer particularly difficult cases to the Board. Furthermore, we feel that the tendency of the Binet Scale, following the usual method of diagnosis, is too severe and results in too high a percentage of feeble-mindedness.

The twenty-six cases tested by the Yerkes-Bridges Scale have been diagnosed by two methods: (1) the C. M. A. (Coefficient of Mental Ability) method, taking .75 as the dividing line between feeble-mindedness and backwardness, and .90 the line between backwardness and normality. This gives us the following distribution:

Normal.....	8	30.5
Backward.....	7	26.8
Feeble-minded.....	11	42.4
Total.....	26	99.7

This group shows a much higher percentage of feeble-minded than the group tested by the Binet. The percentage seems to us unreasonably high. (2) The Three Per Cent. Hypothesis suggested by Pintner and Paterson⁵ using the dividing lines for the groups as computed by them. This gives us the following distribution:

⁵ PINTNER, R., and PATERSON, D. G. *A Psychological Basis for the Diagnosis of Feeble-mindedness.* Journal of Criminal Law and Criminology, Vol. VII, No. 1, May, 1916, pp. 32-55.

Normal.....	9	34.4
Backward.....	13	49.8
Feeble-minded.....	4	15.4
Total.....	26	99.6

Here the percentage of feeble-minded is considerably diminished and the number of backward cases increased. I cannot help feeling that this is a truer statement of the actual mental condition of the cases than that arrived at by the C. M. A. method.

Combining all the 82 cases we arrive at the following distribution:

	Binet and Yerkes (C. M. A.)		Binet and Yerkes (3% Hypothesis)	
	No.	%	No.	%
Normal.....	29	35.4	30	36.6
Backward.....	26	31.7	32	39.0
Feeble-minded.....	23	28.0	16	19.5
Doubtful.....	4	4.9	4	4.9
Total.....	82	100.0	82	100.0

Even the more conservative estimate of 19.5% feeble-minded is high and indicates that this group of State Charity cases is made up of very poor mental material. There are at best only 37% of the children who test up to normal. The large per cent. of backward or dull children is typical of groups of dependent children.

(2) *Children's Home Cases.*

The total population of a county children's home was tested with the Yerkes Scale. Here, again, the results are presented as diagnosed by the C. M. A. standard and by the Three Per cent. Hypothesis. In using the C. M. A. standard the following quintile division was used.

C. M. A.	
Very Bright.....	1.25 and above
Bright.....	1.10 to 1.25
Normal.....	.90 to 1.10
Backward.....	.75 to .90
Feeble-minded.....	.75 and below

In using the Three Per Cent. Hypothesis the limiting points as computed by Pintner and Paterson were used. The table for these limiting points as revised by the authors is given here.

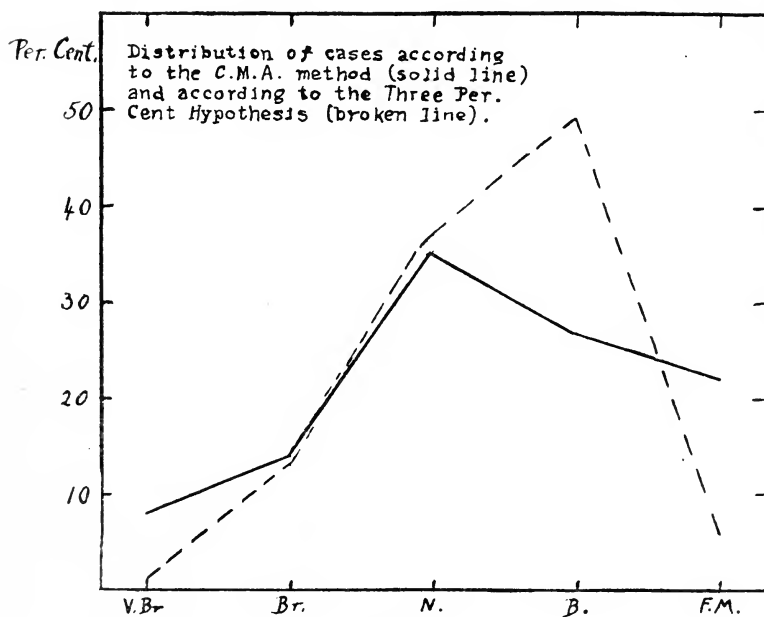
TABLE I

Limiting Points on the Yerkes Scale According to the Three Per Cent. Hypothesis

Age	F. M.	B.	N.	Br.	V. Br.
5.....	Up to 11	-17	-26	-34	35 and above
6.....	13.5	-23	-34	-43	44 " "
7.....	17	-28	-40	-47.5	48 " "
8.....	19.5	-34.2	-47	-57	58 " "
9.....	23	-44	-60.5	-70.8	71 " "
10.....	39.3	-54	-67	-79.7	80 " "
11.....	41.4	-58	-71	-84.6	85 " "
12.....	42.6	-64	-85	-92.8	93 " "
13.....	44.4	-70	-86	-92.8	93 " "
14.....	48.8	-75	-87	-92.8	93 " "
15.....	50.5	-77.5	-89		
16.....	52.5	-79.5	-90		

The results of the two methods of diagnosis are as follows:

	C. M. A.		3% Hypothesis	
	No.	%	No.	%
Very Bright.....	8	7.5	1	0.9
Bright.....	14	13.2	13	12.3
Normal.....	35	33.1	37	34.9
Backward.....	27	25.2	49	46.2
Feeble-minded.....	22	20.8	6	5.7
Total.....	106	99.8	106	100.0



GRAPH I

Graph I shows the distribution of the cases according to each method. It will be noted that the Three Per Cent. Hypothesis gives a curve much closer to the normal curve than the C. M. A. The curve showing the distribution according to the Three Per Cent. Hypothesis is skewed to the left and the majority of the cases fall in the backward group. The C. M. A. standard shows much the same number of feeble-minded and backward cases. Of course the curves prove nothing, but the distribution of the cases according to the two methods is at least suggestive. Those who are acquainted with the type of child sent to our orphan asylums will be inclined to agree with the writer when he says that the common characteristic of the group of children is their backwardness, due to lack of mentality, bad environment and so forth, rather than marked feeble-mindedness. If we accept the C. M. A. standard of diagnosis, we obtain as large a percentage of feeble-mindedness as the best workers have found to be common among juvenile delinquents. The writer is inclined to believe that feeble-mindedness is not as common among unselected dependents as among unselected delinquents.

A comparison of the State Charity cases with the County Home cases shows a much larger percentage of feeble-minded among the former than among the latter, 19.5 per cent. as contrasted with 5.7 per cent. (taking the most conservative estimate in each case). This is due to the fact, which we have already mentioned, namely, that the State Board receives a great many children who are "problems," children who are for various reasons difficult to manage. We might say that as contrasted with the ordinary children's home, the wards of the State Board are a selected group.

Combining the two groups and taking the most conservative diagnosis in each case, we arrive at the following distribution:

	State Charities	Children's Home	Total	Percent
Very Bright.....		1	1	0.5
Bright.....		13	13	6.9
Normal.....	30	37	67	35.6
Backward.....	32	49	81	43.1
Feeble-minded.....	16	6	22	11.7
Doubtful.....	4		4	2.1
Total.....	82	106	188	99.9

(3) *Combined Method of Diagnosis.*

In computing the results of the tests of the Children's Home cases, the diagnosis on the C. M. A. method and on the Three Per Cent. Hypothesis was made in each case. This suggested a distribution of the children into a greater number of groups, determined by the agreement or disagreement of these two methods of diagnosis. If both methods give feeble-minded, the case is called F.M.; if one method gives feeble-minded and the other backward, the case is called B.—F.M., which may be interpreted as being on the borderline between backwardness and feeble-mindedness. If both methods give backward the case is called B. If one gives B. and the other N., the group is called B.—N., which again may be interpreted as lying between backwardness and normality. And so on for the other groups of mentality. It is difficult to tell the value of such a method at the present time, but it would seem to be a method whereby the defects or drawbacks of the one method of diagnosis may be checked or equalized by the other method. We give below the Children's Home cases distributed according to this combined method of diagnosis:

	No.	%
Very Bright.....	1	0.9
Very Bright—Bright.....	7	6.7
Bright.....	6	5.6
Bright—Normal.....	8	7.6
Normal.....	28	26.2
Normal—Backward.....	8	7.6
Backward.....	26	24.5
Backward—Feeble-minded.	16	15.1
Feeble-minded.....	6	5.6
	<hr/> 106	<hr/> 99.8

The insertion of another group between each group of the original quintile division gives a nine-fold classification of the cases. It is interesting to note that of these new groupings, the groups B.—F.M. and V.Br.—Br. receive the relatively largest number of cases, and the new groups around the N. group, i. e. the B1.—N. and the N.—B. groups a relatively smaller number of cases. This seems to mean that the discrepancy between the two methods of diagnosis is greatest at the upper and lower ends of the distribution. The Three Per Cent. Hypothesis has a tendency to shift the cases in the V.Br. and F.M. groups more toward the center of the distribution. It is merely an indication of the tendency of the Three Per Cent. Hypothesis to approach more nearly a normal curve of distribution.

A MENTAL SURVEY OF AN INSTITUTION

The investigation of the children in a County Home grew out of a practical problem that the writer was called upon to solve, namely, to select the feeble-minded children in the Home, so that they might be sent to a more suitable institution. At the beginning of the investigation it was thought that there would not be sufficient time to give the Yerkes-Bridges Point Scale to all the children. This afforded an opportunity to put to the test a theory of the writer's as to the feasibility of employing a group of class tests for a preliminary mental survey of the whole group, after which the poorest, as determined by these class tests, could be given the more thorough examination afforded by the Yerkes or Binet Scale. The plan was to give a certain group of class tests and to rank the children in order of merit on the basis of these tests. The individual mental examination would then be given to as many children as possible, beginning with the lowest in this ranking. This plan, it was thought, would lead most rapidly to the discovery of the feeble-minded in the group without making it necessary to test all the children. In the present case it proved ultimately possible to test all the children with the Yerkes-Bridges Point Scale, so that we can now estimate the usefulness of making a preliminary survey for the selection of suspected cases.⁶

The class tests chosen were such as had been more or less adequately standardized on large numbers of children and among those such as, in the opinion of the writer, seemed most likely to correlate highly with general intelligence. Eight tests were chosen. The time taken to give the tests to a class varied from an hour and a half to two hours. The first five tests were taken from Pyle⁷ and given according to his instructions: (1) Rote Memory (for concrete words only). No attention was paid to bad spelling. Credit was given if what the child wrote resembled in any way the test word.

(2) The Digit Symbol Test.—Time limit, 5 minutes.

(3) The Symbol Digit Test.—Time limit, 5 minutes.

(4) Word Building.—Time limit, 5 minutes. The letters used were A, E, I, R, L, P.

⁶ The writer wishes to acknowledge the help given him in this work by his senior students, and, in particular, by Miss Jeanette Reamer and by his wife.

⁷ PYLE, W. H. *The Examination of School Children*. Macmillan, 1913.

(5) Opposites.—Time limit, one minute.

(6) Cancellation of "a's." The test blank used was not the same as that used by Pyle. Time limit, one minute.

(7) Directions Test A. No time limit.

(8) Directions Test B. No time limit. The score for the last two tests is the number of directions correctly answered. These two tests were taken from Woodworth and Wells⁸ and tentative norms established by the writer were used.

In the first five tests the norms established by Pyle do not extend below age eight. Additional norms for ages six and seven were obtained by the writer from unselected school children.

After these class tests had been given to the children, the scores obtained on each test were turned into equivalent mental ages by reference to the tables of norms. Half and quarter years were interpolated if the actual scores fell in between the norms for any two ages. In this way each child has a number of mental ages according to the number of class tests used. The median of these mental ages is the mental age attained by the child on the basis of the class tests. The mental ages for each test for each child and the median mental ages are given on Table II.

Eighty-eight cases are shown in this Table, *i. e.*, eighteen less than the total number tested with the Yerkes Scale. Some of the children were absent when the class tests were given and some were too young to take the tests. The first line of the table is to be read as follows: Child No. 1 is seven years old and made a performance on the Rote Memory test about equal to an average five-year-old child, on the next four tests the performance was about equal to an average six-year-old, on the Cancellation test about equal to a five-year-old, on Directions Test A to a seven-year-old, on Directions Test B to a six-year-old and the median mental age as derived from all these tests is six.

For some of the tests at some ages no norms were available and therefore no mental age could be assigned to the child's performance on the test.

In order to find out how closely the ranking of the children on the class tests corresponded to their ranking on the Yerkes Scale the intelligence quotient for the class tests and the coefficient of mental ability for the Yerkes Scale were computed.

⁸ WOODWORTH, R. S., and WELLS, F. L. *Association Tests*. Psychological Monographs, Vol. 13, 1911. Whole No. 57.

TABLE II
Mental Ages on Class Tests

No. of Case	Age	Rate Mem.	Digit Symbol	Symbol Digit	Word Bldg	Opposites	Cancel-lation	Directions A	Directions B	Median M. A.
1	7	5	6	6	6	6	5	7	6	6
2	7	7.25	6	6	7	6	7.5	6.5	5	6.25
3	7	7	6	6	7.5	7	6.5	7	7	7
4	7	7.5	7.5	8.25	8	7.25		8.5	8.5	8
5	7	8	6	6	7	7.25		7.75	8.5	7.25
6	8	6	7	6	6	6	5	7	6	6
7	8	6.5	7.5	6	6	6	5.75	6.5	5	6
8	8	4	7	6	6	6	5			6
9	8	7	7.5	7.25	7.5	7.25	6		6	7.25
10	8	7.5	7	6	7.5	7	8	7.5	8	7.5
11	8	7.5	7.5	7.5	7.5	7.5		8.5	8.25	7.5
12	8	6	7	6	6	6	8	7.5	8.25	6.5
13	8	7.25	7.5	7.5	7.5	7.75		8.5	8.25	7.5
14	8	7	7.5	7.5	7.5	7				7.5
15	8	7.5	7.5	7.5	7.5	7.75	6.5		8.5	7.5
16	8	7.5	8.75	8.5	7.5	7.75		8.5	7.25	7.75
17	8	7.5	7.5	7.5	8	7.5	8		8.5	7.5
18	9	7.5	7	6	7.25	6	7	7.25	7	7
19	9	5	7.5	7.5	6	11	5		5	6
20	9	7.5	7.5	6	7	6	7.5	7.75	8.25	7.5
21	9	7.5	7	6	6	6		7.5	7.5	7
22	9	7.5	7.5	8	7.5	7.5		10	8.5	7.5
23	9	7.5	7.5	7.5	7.5	7.5	6		7.75	7.5
24	9	7.5	7.5	7.5	8	8		8.25	8	8
25	9	8	6	7.5	8	8		13.5	8.5	8
26	9	8	8.5	9	9	10		13.5	15	9
27	10	6.75	7.5	7.5	7	7		8.5	7	7
28	10	7	6	6	7.5	6	8	7.5	7.5	7.25
29	10	7.5	6	6	7	10.5	8	7.25	7	7.1
30	10	7.25	7.5	6	7.25	6		7.75	8.25	7.25
31	10	7.25	7.5	7	8	7.5		8.25	8.5	7.5
32	10	6	7.5	7.5	7.5	7.25			8.5	7.5
33	10	7	7	7	7.5	7.5	8	8.5	8.5	7.5
34	10	7.5	7.5	7.5	7.25	7.5	7	7.25	7.5	7.5
35	10	8	9	8.75	9.5	7.5		8.5	8.5	8.5
36	10	10.5	7.5	7.5	7.75	7.75	7	8.25	8	7.75
37	10	7	7.5	8.5	7.25	7.5			8	7.5
38	10	7.5	8	8.75	9	7.5		10	8.75	8.75
39	10	7.5	12	12.5	7.5	9	6	8.5	8.75	8.6
40	11	6.5	7.5	7.5	7	7.25	6.5		6.25	7
41	11	6.5	7	7.5	6	6	5.5	7.25	6.25	6.3
42	11	6	6	7	7	6	6.5	5	5	6
43	11	6.25	7.5	7.5	7.5	7			8.5	7.5

TABLE II
Mental Ages on Class Tests

No. of Case	Age	Rote Mem.	Digit Symbol	Symbol Digit	Word Bldg.	Opposites	Cancellation	Directions A	Directions B	Median M. A.
44	11	7.5	8.5	8.25	8			7.5	7	7.75
45	11	6	7.5	7.5	8	7.25		7	7.25	7.5
46	11	10	7.75	7.5	8	7.5			8.5	7.8
47	11	8	8	7.75	9	8		8.5	8.5	8
48	11	10.5	7.75	9.5	8	7.5		8.75	8.5	8.5
49	11	10.5	9	8.75	7.5	7.5	8	8.5	8.25	8.3
50	11	7.5	9.5	9.5	9	7.5		8.75	8.5	8.5
51	11	10.5	8	8.75	7.5	7.5	6.25	10	9	8.4
52	11	13.5	8.5	12	8	14		8.75	8.5	8.75
53	11	10.5	8.5	11	7.5	7.25		10	11.5	10
54	11	12	8	7.5	9	8		8.5	11.5	8.5
55	11	12	11.5	16	8	10		10	11.5	11.5
56	12	10.5	7.75	11.5	7.5	12		8.5	8.5	8.5
57	12	7.5	9	12.5	7.25	7.75		10	9	9
58	12	7.75	7.5	7.5	8	7.75		8.5	8.5	7.75
59	12	7.25	8.75	8.5	7.5	7.5		8.5	8.5	8.5
60	12	8	8.75	11.5	9.5	9		10	8.75	9
61	12	11	9.25	9.75	10	7.5		13.5	8.5	9.75
62	12	17.25	17	18	13	12		13.5	15	15
63	12	14	9	12.5	12	13		16	11.5	12.5
64	12		11.5	12	8	10.5		16	15	11.75
65	13	7.75	7.5	7.5	8	7.5	6.5	8.5	7.5	7.5
66	13	7.5	7.75	8.5	7	7.5	7.5	8.5	8.25	7.5
67	13	7	7.5	7.5	7.5	7.25	8		8.5	7.5
68	13	7.5	11.5	9.5	7.5	7.5		8.5	9	8.5
69	13	8	7.5	7.75	7.5	7.25			8.5	7.6
70	13	7.75	13.5	13	8	7.5		8.5	8.75	8.5
71	13	7.75	7	9.5	9.5	9		10	11.5	9.5
72	13	7.5	7	7	7	7.5		7.5	8.5	7.5
73	13	17.5	12.5	13.5	10.5	8		10	15	12.5
74	13	7.25	9.5	10.5	9.5	9		10	Ad.	9.5
75	13	17.5	12.25	14.5	9.5	8		10	15	12.25
76	14	10.25	12	9.25	10.5	10		13.5	15	10.5
77	14	7.5	9	10	7.25	7.5		8.5	8	8
78	14	7.75	8.75	10.5	9	7.25		8.5	8.5	8.5
79	14	7.5	11.5	12.5	7	7.5		8.5	8.5	8.5
80	14	7	7.75	7.75	7.25	7.5		8	8.5	7.75
81	14	10.5	8	11	8	8		13.5	11.5	10.5
82	14	7.5	7.25	8.75	7	7.25		8.5	8.5	7.5
83	14	7.5	7.5	9.5	7.75	9		10	9	9
84	14	7.5	12.25	13.5	8	7.5		13.5	Ad.	12.25
85	15	7.5	7.5	7.5	7.5	8		8.5	7.25	7.5
86	15	7.25	8.75	12.75	7	7.5		8.75	8.5	8.5
87	16	10.5	9	13.5	8	11		13.5	15	11
88	16	18	12.5	Ad.	14	13		16	Ad.	16

TABLE III
Class Tests and Yerkes Scale

Number of Case	Class Med. M. A.	Tests I. Q.	Yerkes M. A.	Scale C. M. A.	Difference
1.....	6	.87	5.8	.82	— .05
2.....	6.25	.91	8.24	1.23	+ .32
3.....	7.0	1.00	8.4	1.29	+ .29
4.....	8.0	1.16	8.5	1.32	+ .16
5.....	7.25	1.05	10.4	1.62	+ .57
6.....	6	.75	5.0	.56	— .19
7.....	6	.75	6.8	.84	+ .09
8.....	6	.75	7.8	.97	+ .22
9.....	7.25	.91	8.0	1.00	+ .09
10.....	7.5	.94	8.24	1.08	+ .14
11.....	7.5	.94	8.3	1.10	+ .16
12.....	6.5	.81	8.56	1.18	+ .47
13.....	7.5	.94	8.56	1.18	+ .24
14.....	7.5	.94	8.64	1.20	+ .26
15.....	7.5	.94	8.8	1.26	+ .32
16.....	7.75	.97	9.28	1.38	+ .41
17.....	7.5	.94	9.28	1.38	+ .44
18.....	7.0	.78	8.2	.79	+ .01
19.....	6.0	.67	8.24	.81	+ .14
20.....	7.0	.78	8.5	.86	+ .08
21.....	7.0	.78	8.64	.90	+ .12
22.....	7.5	.83	8.72	.92	+ .09
23.....	7.5	.83	9.28	1.04	+ .21
24.....	8.0	.89	9.42	1.07	+ .16
25.....	8.0	.89	10.0	1.13	+ .24
26.....	9.0	1.00	10.8	1.21	+ .21
27.....	7.0	.70	8.08	.62	— .08
28.....	7.25	.72	8.2	.70	— .02
29.....	7.1	.71	8.32	.73	+ .02
30.....	7.25	.72	8.4	.75	+ .03
31.....	7.5	.75	8.5	.76	+ .01
32.....	7.5	.75	8.5	.76	+ .01
33.....	7.5	.75	8.72	.81	+ .06
34.....	7.5	.75	8.72	.81	+ .06
35.....	8.5	.85	9.0	.88	+ .03
36.....	7.75	.77	9.28	.91	+ .14
37.....	7.5	.75	10.0	1.00	+ .25
38.....	8.75	.87	11.3	1.13	+ .26
39.....	8.6	.86	13.5	1.29	+ .43
40.....	7.0	.64	6.0	.45	— .19
41.....	6.3	.57	6.4	.48	— .09
42.....	6.0	.55	8.32	.67	+ .12
43.....	7.5	.68	8.5	.70	+ .02
44.....	7.75	.70	8.64	.74	+ .04

TABLE III
Class Tests and Yerkes Scale

Number of Case	Class Med. M. A.	Tests I. Q.	Yerkes M. A.	Scale C. M. A.	Difference
45.....	7.5	.68	8.72	.75	+.07
46.....	7.8	.71	8.8	.77	+.06
47.....	8.0	.73	9.42	.86	+.13
48.....	8.5	.77	9.84	.91	+.14
49.....	8.3	.76	11.0	1.00	+.24
50.....	8.5	.77	11.1	1.01	+.24
51.....	8.4	.76	11.1	1.01	+.25
52.....	8.75	.80	11.7	1.11	+.31
53.....	10.0	.91	11.9	1.14	+.23
54.....	8.5	.77	12.5	1.15	+.38
55.....	11.5	1.05	15.5	1.27	+.22
56.....	8.5	.71	9.6	.77	+.06
57.....	9.0	.75	9.84	.78	+.03
58.....	7.75	.65	10.6	.84	+.19
59.....	8.5	.71	11.4	.92	+.21
60.....	9.0	.75	11.9	.99	+.24
61.....	9.75	.81	11.9	.99	+.18
62.....	15.0	1.25	14.0	1.05	-.20
63.....	12.5	1.04	17.0	1.14	+.10
64.....	11.75	.98	Ad.	1.24	+.26
65.....	7.5	.58	7.2	.47	-.11
66.....	7.5	.58	8.64	.63	+.05
67.....	7.5	.58	8.88	.68	+.10
68.....	8.5	.65	9.0	.70	+.05
69.....	7.6	.59	9.42	.74	+.15
70.....	8.5	.65	10.6	.84	+.19
71.....	9.5	.73	11.0	.86	+.13
72.....	7.5	.58	11.3	.90	+.32
73.....	12.5	.96	11.9	.99	+.03
74.....	9.5	.73	11.9	.99	+.26
75.....	12.25	.94	13.25	1.02	+.08
76.....	10.5	.75	9.42	.70	-.05
77.....	8.0	.57	9.56	.72	+.15
78.....	8.5	.61	10.4	.78	+.17
79.....	8.5	.61	10.4	.78	+.17
80.....	7.75	.55	10.6	.79	+.24
81.....	10.5	.75	10.5	.80	+.05
82.....	7.5	.54	11.6	.90	+.36
83.....	9.0	.64	11.6	.90	+.26
84.....	12.25	.87	11.9	.93	+.06
85.....	7.5	.50	8.64	.59	+.09
86.....	8.5	.57	8.72	.60	+.03
87.....	11.0	.69	11.9	.89	+.20
88.....	16.0	1.00	18+	1.06	+.06

The I. Q. (Intelligence Quotient) is obtained by dividing the mental age by the chronological age, and the C. M. A. by dividing the score obtained by the average score for the age in question. Each may be said to express the "percentage of normality" for the intelligence of the child, 1.00 being normal.

Table III shows the comparison between the class tests and the Yerkes scale. Column 1 gives the number of the case; column 2 the median mental age on the class tests; column 3 the intelligence quotient of the class tests; column 4 the mental age on the Yerkes Scale; column 5 the C. M. A. on the Yerkes Scale; and the last column the difference between the C. M. A. and the I. Q., the positive sign indicating a difference in favor of the C. M. A.

It will be noted that the mental ages as determined by the class tests are in most cases lower than those arrived at on the Yerkes Scale. In fact, there are only nine cases which test lower on the Yerkes Scale than on the class tests, that is, 79 out of the 88 cases show a somewhat higher C. M. A. on the Yerkes Scale than an Intelligence Quotient on the class tests. If the Yerkes Scale gives a reliable mental age, then the class tests, with the present standardation, are obviously a little too severe. The almost uniform tendency of the class tests to rate the subjects lower than the Yerkes Scale does not, however, make them invalid for our purpose since they are merely to be used to determine the relative standing of the children. That the ranking of the cases is much the same by the class tests as by the Yerkes Scale is shown by the correlations.

The correlations for each age group computed by the Spearman Foot-Rule Method are as follows:

Age	R	r	P. E.
8.....	.60	.81	.0486
9.....	.77	.94	.0256
10.....	.74	.92	.0256
11.....	.79	.95	.0256
12.....	.54	.75	.0688
13.....	.53	.74	.0688
14.....	.17	.26	.1295

These are fairly high in almost all age groups, except in age fourteen. The correlations between the class tests and the Yerkes Scale of all the 88 cases together is, $R = .59$; $r = .80$ with a P. E. of about .0280. This coefficient is naturally high because we are dealing with a heterogeneous group including children varying from age 8 to age 14.

PRACTICAL ADVANTAGES OF CLASS TESTS

We shall now discuss the practical advantage of having a rough grading of the children on the class tests in order to make a selection for individual tests, and see how this actually works out in practice. The psychologist who is called upon to select the feeble-minded in an institution rarely has the time to test all the children, and unless he is making a thorough investigation, it would be needless for him to do so. He may follow two methods in selecting a limited number of children to be tested: (1) according to the choice of the superintendent or teachers; (2) according to his own choice. The efficacy of the latter method is, of course, dependent upon the thoroughness with which he goes over the cases. It may vary all the way from a brief visit in the school room, during which two or three children are selected for examination, to a special interview with each child. We can scarcely compare this method with the results of the selection by class tests. It is too variable a quantity. If the selection is rapidly made it will be faulty; if the individual interview is long, we approach a kind of mental examination of each case.

The other method of selection, *i. e.*, by the superintendent or teachers, can be tested with our data. Before the testing was begun the superintendent of the Home submitted a list of the children whom he suspected of backwardness or feeble-mindedness. There were 23 in this list. We may now compare this selection of 23 with the lowest 23 as determined by the class tests. If we had followed the superintendent's advice, we should have tested the 23 of his selection; if we had followed the class tests we should have tested the 23 lowest as chosen by their I. Q's. Below is given the distribution of these two methods of selection arranged according to the combined method of diagnosis:

	Superintendent's Selection		Class Tests	
	No.	%	No.	%
Feeble-minded.....	3	60	5	100
Feeble-minded—Backward.	6	46	7	54
Backward.....	5	22	8	35
Backward—Normal.....	1	14	3	43
Normal.....	6	30		
Normal—Bright.....	1	14		
Bright.....				
Bright—Very Bright.....	1	14		
	<hr/> 23		<hr/> 23	

Comparing the two methods of selection we note that by the superintendent's selection only 60% of the feeble-minded would have been detected, whereas by the class tests every one would have been examined. In the F.M.—B. class 46% would have been detected by the superintendent's selection, and 54% by the class tests. In the B. and B.—N. classes the class tests give a higher percentage in each case. In brief a much higher percentage of all those below normal would have been examined on the selection made by the class tests. Conversely eight children testing normal or above would have been examined on the superintendent's selection, and this work may be regarded as so much waste of time if the sole object had been to detect the cases of lowest mentality. This waste may be represented as follows according to the end desired by the examination:

	Superintendent		Class Tests	
	No.	% of 23 cases	No.	% of 23 cases
All Normal and above called superfluous.....	8	34	None	
All Backward—Normal and above called superfluous.....	9	39	3	13
All Backward and above called superfluous.....	14	61	11	47

This comparison is not exactly fair if we put it in terms of actual time spent in testing, since we must not forget that the giving of the class tests takes a considerable time. Let us therefore attempt a comparison in terms of actual time. Supposing that it will take two days to test 23 children on individual scales, then this amount of time would have been spent in testing the 23 cases selected by the superintendent. It would take a day to test the children on the class tests, and the second day might be devoted to the examination of say eleven cases, *i. e.*, half of twenty-three. This would give two days devoted to examination in each case. The results would be as follows:

	Superintendent		Class Tests	
	No.	%	No.	%
Feeble-minded.....	3	60	4	80
Feeble-minded—Backward	6	46	4	31
Backward.....	5	22	1	43
Backward—Normal.....	1	14	2	29
Normal.....	6	30		
Normal—Bright	1	14		
Bright.....				
Bright—Very Bright.....	1	14		

Again the class tests method, in spite of the fact that only half the children have been examined individually, gives a larger percentage of feeble-mindedness, but it shows a lower percentage of the F.M.—B. group. The percentage in the backward group is in favor of the class tests. It would seem, therefore, that as far as actual time is concerned, the class test method has given as good, if not better, results than the method of relying on another's subjective judgment of the mentality of the children. In general the question of time is not likely to be as acute as we have represented it here and the examiner will, as a rule, prefer the more reliable method even although it may take a day or two longer.

Naturally all that we have said above is in regard to one superintendent's choice, and is not to be taken as a sample of what every superintendent will do. Those who are acquainted with superintendents of Children's Homes and similar institutions will recognize from the results given that the superintendent in question was distinctly above the average in his knowledge of the problem of mental deficiency. His selection is good and shows a knowledge of his wards. There are very few superintendents, I think, who would have been able to do better. The necessity for a preliminary survey by class tests will, therefore, apply with much greater force to institutions in which the superintendent has little knowledge of the problem of mental deficiency.

Assuming that we are using the class test method for a preliminary survey, we may raise the further question as to what proportion of the children should be tested later by individual tests. No dogmatic answer can be given to this question and in actual practice it will be largely a question of the time at the disposal of the examiner and the thoroughness with which the mental survey is to be made. We give below the results that would have been obtained under the following conditions: (1) if the lowest one-eighth of the children had been tested; (2) if the lowest one-fourth had been tested; (3) if the lowest one-third had been tested; (4) if the lowest one-half had been tested.

(1) If the lowest one-eighth had been tested, there would have been eleven children (with Intelligence Quotients on the class tests from .50 to .58). Their distribution on the basis of the Yerkes Scale gives:

Feeble-minded.....	4 or 80 per cent. (i. e. 1 not detected)
Feeble-minded—Backward.....	4 or 31 per cent.
Backward.....	1 or 43 per cent.
Backward—Normal.....	2 or 29 per cent.

Even taking such a small number we find that the class tests account for a very large percentage of the feeble-minded.

(2) If one-fourth had been tested, there would have been 22 cases (with I. Q. below .69) distributed as follows on the Yerkes Scale:

Feeble-minded.....	5 or 100 per cent.
Feeble-minded—Backward.....	7 or 54 per cent.
Backward.....	7 or 31 per cent.
Backward—Normal.....	3 or 43 per cent.

This includes all the F.M. group and about half the F.M.—B. group.

(3) If one-third had been tested, there would have been about 29 cases (with I. Q. below .72) and they would have distributed themselves as follows, on the Yerkes Scale:

Feeble-minded.....	5 or 100 per cent.
Feeble-minded—Backward.....	10 or 78 per cent.
Backward.....	10 or 43 per cent.
Backward—Normal.....	3 or 43 per cent.
Normal.....	1

This includes all the F.M. group and all but three of the F. M.—B. group. These three cases had I. Q's somewhat above .71. We give the main figures for these three cases:

1. I. Q. on Class Tests=.75. C. M. A.=.70. Chron. Age=14.
2. I. Q. on Class Tests=.75. C. M. A.=.56. Chron. Age= 8.
3. I. Q. on Class Tests=.72. C. M. A.=.70. Chron. Age=10.

(4) If one-half of the children had been tested, there would have been 46 cases. It would have been necessary to take 46 instead of 44, because there was a group with the same I. Q's on the class tests. These 46 cases have I. Q's below .76. The distribution on the Yerkes is:

Feeble-minded.....	5 or 100 per cent.
Feeble-minded—Backward.....	13 or 100 per cent.
Backward.....	20 or 87 per cent.
Backward—Normal.....	3 or 43 per cent.
Normal.....	5 or 25 per cent.

If the lower half of the cases as determined by the class tests had been tested all the cases of feeble-mindedness, even on the liberal basis of .75 C. M. A., would have been detected, and in addition almost all the definitely backward. Furthermore, the

waste of time involved in testing normal children or children above normal would seem to have been reduced to a minimum.

It would seem to me, therefore, that a group of well standardized class tests would form an excellent means for the first rough grading of children according to their mentality and, indeed, an excellent method for carrying out mental surveys on a larger scale. We are working on this problem at the present time and hope shortly to arrive at a well standardized group of class tests for the testing of large groups of individuals.

COMMUNICATIONS AND DISCUSSIONS

DIRECTED ATTENTION AND LEARNING

A number of experimental investigations of memory have shown that the beginning and the end of a series of syllables or of a selection of poetry are learned more rapidly than is the middle. Since this is the case, it would seem possible that the general efficiency of learning might be improved by directing the learner's attention to the middle of the material, the part least strongly impressed, allowing the ends to take care of themselves as they appear to do. The work here reported was undertaken to test this suggestion, which is due to Professor D. K. Fraser.

Three kinds of material were used in the experiment: nonsense syllables, Chinese vocabularies, and poetry. The method of procedure was a combination of the method of complete mastery and savings with the method of helps in the case of nonsense syllables and poetry, and with the method of right associates in the case of the vocabularies. The procedure was so arranged that it showed the distribution of errors between the various parts of the series. Retention was tested only for a period of one day.

Attention to the middle of the series was obtained by the instructions: "You are to attend particularly to the middle of the series and try especially to learn it." The part to be attended to (the middle third) was marked by a line drawn on the left of the printed series. Normal series were obtained for comparison, using the instructions: "Do not attend to any special part of the series."

Three observers took part in the experiment. Two of these were untrained in psychological observation. Their gross results were extremely variable; increases and decreases in efficiency with directed attention, most of them trivial, were scattered promiscuously among the various measures obtained. But an examination of the distribution of errors within the series by these observers showed that with neither of them were the instructions to attend to the middle effective in securing better learning of the middle. This conclusion is borne out by their introspections. The results of these observers were therefore useless for our problem.

But in the case of our third observer, who was trained in psychological observation, the instructions to attend to the middle were effective in securing better learning of the middle of the series, as

evidenced both by the distribution of errors and the observer's introspective report. Moreover, the results of this observer are quite definite. Attention to the middle of a series of nonsense syllables resulted in a considerable improvement both in learning and in remembering, there being a decrease in the number of errors as well as in the number of repetitions required to learn and relearn the directed as compared with the normal series. This decrease ranges from twenty to fifty per cent. There is also a gain in efficiency in the case of poetry, but it is not so great. With Chinese vocabularies, however, concentration on the middle of the series resulted in a small loss of efficiency. The gain at the middle of this non-serial material did not compensate the loss at its ends.

These results show that special attention to the middle of a series, when it can be obtained, is of advantage in learning serial material, but not in learning material of a non-serial nature. The results for the one observer for whom the method was effective are so clear-cut that they warrant further investigation, either by the further use of trained observers or by other methods of directing attention to the center.

GILBERT J. RICH.

Cornell University.

ABSTRACTS AND REVIEWS

HAROLD O. RUGG. *The Experimental Determination of Mental Discipline in School Studies*. Baltimore: Warwick and York, 1916. Pp. 132. \$1.25.

Dr. Rugg has made an important contribution to the solution of the problem of formal discipline by making an investigation of the transfer-effects of a school study itself. His purpose was to ascertain whether the training in visualizing obtained from a semester's course (15 weeks) in descriptive geometry improved the ability to visualize in related fields of work, and if so, to what extent. The training was the regular course in that subject required of all freshmen in the College of Engineering in the University of Illinois. The course, which should not be confused with the usual plane and solid geometry, has for its purpose "to build up for the student a method of picturing solid objects (*e. g.*, machines like engines, dynamos, their constituent parts, and the diverse materials used in engineering of all sorts) on one plane called the plane of projection, and coincident with the drawing paper." From experience in teaching the subject Dr. Rugg came to the conclusion that it gave a very thorough training in the visual imagining of geometrical objects. The training subjects were 326 freshmen in this course, the control subjects were 72 juniors and seniors in the School of Education, and 15 Engineering freshmen not taking descriptive geometry.

The six tests designed to measure the spread of training were of three types: (1) *tests with non-geometrical elements*. These were (a) ten examples in short division, such as, "Divide eighty-one by seven" (time 60 secs.); (b) ten examples in short division, such as, "Divide thirty-four fifty-two by nine" (time 90 secs.); and (c) form as many words as possible out of the word 'material' (time 5 mins.). (2) *Tests with quasi-geometrical elements*. The subjects were asked to tell the number of straight lines required to write each of twelve words, using a straight-line alphabet shown for a short time just before the test (time 75 secs.). (3) *Tests with strictly geometrical elements*. (a) A three-inch cube painted white on all sides is cut into one-inch cubes. How many cubes have paint on three sides, how many on two, on one, on no sides? (Time 80 secs.). (b) Form a mental picture of each of the following objects in turn, and count the number of straight lines it would take to construct each in space. Then follow 8 problems, such as, (1) A wedge. (2) Four triangles

attached to a square, bases coinciding with the sides of the square. (5) A triangular pyramid resting on a triangular prism, bases coinciding. (Time 90 secs.)

These six tests were given to both training and control subjects before and after the course in geometry. In the pre-training tests the training subjects did substantially better than the controls. In the post-training tests both groups improved, but the training subjects made 7.44% greater gain in efficiency (number done correctly) than the control subjects in the non-geometrical tests, 20.4% greater gain in the quasi-geometrical test, and 31.25% greater gain in the strictly geometrical tests. Statistical analysis showed that the superiority was well distributed throughout the training group.

The author thinks these excess gains of the training group are due to training, principally in visualization, received in the course in geometry. The tests are framed to test principally visualization, and the other courses taken concurrently with the geometry offer no training in visualization at all comparable with that offered by the geometry. Granting this, we are somewhat in doubt how large the gains are, since the question is, what proportion of the gains in training was transferred, and the improvement in visualization in training was not measured. The author regards all three gains as "substantial."

Opinions will differ as to importance of these transfers according to the extent to which the training and the tests are thought to resemble each other. The causes of transfer throw some light upon the matter. (1) The course in geometry developed a stock of imagery concepts (lines, squares, triangles, prisms, etc.), a familiarity with them, and a skill in manipulating them, which was of direct aid in the painted cube test, and in counting the edges of the figures in the last test. (2) The course increased the span of attention, enabled the person to hold more elements in mind at once, and for a longer time. Its effect was noted in the short division tests even. (3) The course is essentially a course in problem-solving, and tends to make the person conscious of the value of a good method of attack, hence to make him inclined to seek one in any of the tests. I am disposed to think there is a strong resemblance in content between the course and the tests with strictly geometrical elements, but not much between it and the other tests. The transfer factors in these other tests seem to be notions of procedure, and a better control of attention.

On the whole the investigation shows that the training, principally in visualizing, received from the course in geometry is used in other fields, usually reckoned somewhat different. The decrease as the tests become more different from the training is of course significant. The results afford, in the opinion of the author, and it seems to me justified, some support for a considerably restricted view of formal discipline. The book contains excellent tabular summaries and critical analyses of all the experiments to date. The statistical handling of the results, a feature we have not done justice to, is the best of all the researches on the subject yet published.

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EDITORIALS

The economic issue is often the determining factor in human betterment. The educational world will see a striking illustration of that in the next few years, in that the now rapidly growing movement in the direction of scientific vocational selection at the entrance to industrial and various other types of employment will force upon the school system the necessity of making that selection at the beginning of vocational training, where such is furnished, in order not to sacrifice the training through misdirection.

FROM VOCATIONAL SELECTION TO VOCATIONAL GUIDANCE

It will soon be known that, when a youth knocks at the door of professional industry, questions will be asked as to his fitness. If a vocational school prepares for the various crafts, arts, and other forms of skillful activity in a large city, the tax payer has a right to know whether or not the children who enter upon a course of training are by nature fitted for the occupation to which it will lead. Thus, the purely economic issue, quite regardless of interest in the child, will force upon as applied psychology in the determination of fitness for

occupations in the early stages of vocational training. The educational psychologists, therefore, face a very specific issue for the next few years, namely, that of standardizing tests for specific occupations, not by sporadic use of what happens to be at hand when a community must be served, but by years of intensive and persistent coöperation in the attack upon a few of the most promising points of vantage.

A good example of this to start with would be that of fitness for stenography. Work in this field has been done in several places, but on the mistaken notion that you could pick up floating tests of intelligence, association, and reaction time and proceed to guide. Against this we must enter a most sincere protest in the interest of the integrity of applied psychology. Psychology must learn from physics and medicine that it must first solve its problems in the laboratory, and take time to do this with scientific honesty, before it can formulate rules for practice.

C. E. S.

Many well-meaning people, realizing the nation's lack of preparedness for self-defense, and seeing in the high schools groups of youths that are easily accessible, are clamoring for military training in the schools. In many communities and in some states such training has been made obligatory by law. There is undoubted need for a more effective mobilization of the nation's strength in critical times like the present, but we believe that it is unjust, unwise and inefficient to lay the burden of military training upon high schools.

It is unjust, because it involves an undemocratic discrimination. If military training means anything it means greater readiness for war. But in a democratic state war is the concern of every citizen, and preparation for it is not a matter to be relegated to the few selected youths that attend the high schools. Universal training is the only way to meet the needs of democracy, and the recent action of Congress on the selective draft bill gives official sanction to this policy.

It is unwise, because no one at the present time knows what military training might profitably be given in high schools. The conditions of waging war have undergone such change that traditional military tactics are obsolete. The one definite conclusion emerging from the chaos of accounts is that parade-ground drill and close formation tactics have little place in actual war. The activities required seem

to be those of digging like a mole, crawling like an Indian, shooting a rifle with periscope sights, handling a machine gun, using a gas mask, living in dug-outs, and especially enduring nonchalantly the most deafening and destructive artillery bombardment. High school boys might be trained in some of these things, but military authorities are agreed that such training demands camp life and the undivided time and energies of the men, and is incompatible with the finely divided high school program. Moreover, high school boys of fourteen to eighteen years of age are too immature to be subjected to intensive training of this sort. Much more could be accomplished in a shorter time, if the military training were postponed to the age of nineteen or twenty.

It is inefficient, because it distracts attention from the true function of the schools, which is to prepare each pupil to render the greatest possible service in both peace and war. Success in war is a matter of organization, of railroads, of steamships, of air planes, of food, of raw materials, but above all things it is a matter of highly developed and well-directed human intelligence. Instead of the ridiculous spectacle of some thousands of high school boys strutting about for a few periods each week with guns on their shoulders, we should see both elementary and high schools articulated with a national system of defense for the attainment of the most complete physical, intellectual and social development of each pupil. This should include provision for physical education, personal and group hygiene, sanitation, dietetics, the most important sciences, and the social, economic and historical background of our present-day life. But this will not be enough. The state must see to it that no boys are given working papers and allowed to shift for themselves at the age of fourteen, fifteen or sixteen. The individual aptitudes, capacities and interests of each boy and girl must be scientifically studied, and each must be well started on the road to permanent productivity under the auspices of a bureau of vocational guidance and national conservation. Thus, whether for peace or war, each citizen will be trained in the service he can best render the state, and the state will know just what individuals should be called upon for any particular service. Then, when war is declared, instead of the present bickering and dilly-dallying, each will go at once to his post, and the entire nation can be mobilized for effective action within a few weeks.

J. C. B.

NOTES AND NEWS

Readers of the JOURNAL will recall that in the December number Dr. J. Crosby Chapman, of Western Reserve University, criticized the method of evaluating blanks in completion tests on the basis of the frequency with which degrees of difficulty were specified by the different subjects, and suggested that the most direct method "would be to measure the actual time taken by all the subjects for the completion of each of the elisions and on the basis of these times to define the values of the difficulties." An extract from a personal letter by Professor Irving King, of the University of Iowa, will be of interest in this connection. Professor King writes, "We experimented extensively with this method of measuring different degrees of difficulty and finally abandoned it as quite incapable of yielding accurate results, for the simple reason that in filling such elisions it is impossible to determine the separate time for each elision. The subject does not work with one elision at a time but on several at once, looking ahead and getting suggestions for the one directly in the focus. The effort could not be isolated for one elision at a time. The problem presented by a sentence containing several difficult elements was solved as a whole, not element by element."

Declaring that better educational results can be secured in California for the money now expended on education, and that an attempt will be made to demonstrate the fact, Director Herbert W. Clark, of the Taxpayer's Association of California, has announced the creation by the Association of a special Bureau of Educational Investigation, which will immediately undertake a thorough analytical survey on a state wide basis. The survey will be conducted by Mr. Wilford E. Talbert, who for the past three years has been director of reference and research of the Oakland public schools. The services of Professor Ellwood P. Cubberley, of Stanford University, as consulting expert have been secured. It is stated that the purposes of the survey are constructive, not destructive, and that the attempt will be made to bring to the taxpayers a clearer realization of the value of good schools and to secure the best educational results for the money expended. A survey conducted on this high plane of public service should be productive of significant results for education not only in California but in the country as a whole.

Under the auspices of the National Committee for Mental Hygiene a survey of mental defectives in the state of Kentucky has been authorized by the state commission on the feeble-minded. The survey will be conducted by Dr. Thomas H. Haines, professor of nervous and mental diseases at Ohio State University and director of the State Bureau of Juvenile Research. Dr. Haines has been granted a five months' leave of absence from his duties in Ohio.

The fourth annual conference on educational measurements was held at the University of Indiana, April 20 and 21. The speakers from abroad were Professor G. D. Strayer, Teachers College, Columbia University, and Dr. C. H. Judd, director of the school of education of the University of Chicago. Professor Strayer spoke on the "Scoring of School Buildings," "Standardizing the School Plant," "Significance and Present Status of the Survey Movement," and "Practical Improvement in General School Administration Resulting from the School Survey." The titles of Dr. Judd's addresses were "Reading Tests," "Experiment in Education," and "Practical Results Obtained through the Use of Standardized Tests in School Achievement." Other papers presented were "A Study of Handwriting (Ayres Scale)," by Professor William W. Black; "A Study of Reading (using Gray Oral and Silent Tests) in Indiana Cities," by Cecile W. White; and "A Study in Arithmetic (Courtis Tests, Series B) in Indiana Cities," by Dean H. L. Smith.

Mr. S. A. Courtis, supervisor of educational research, Detroit Public Schools, invites the coöperation of superintendents and supervisors in an investigation of the efficiency of different methods of teaching reading to be undertaken in May of this year. Mr. Courtis has devised a special reading test for this work and desires to secure as much data as possible on the reading of the grades from the second to the sixth. The test is a rate test and not a reading scale. The difficulty of the questions is about equal to Difficulty 5.5 of the Thorndike Scale. The materials of the test will be furnished at cost, and a bulletin of results and standards will be sent free to those who contribute scores. Tabulations of the results will begin about July 1 and will be ready for use at the opening of school in September. Those who are interested should write immediately to Mr. S. A. Courtis, 82 Eliot Street, Detroit, Michigan.

Friends and admirers of the late Professor Hugo Münsterberg have purchased, and presented to Harvard University as a memorial, his extensive private library on psychological subjects. The library consists of about ten thousand books, reprints, pamphlets, manuscripts, charts and other papers, including the latest and most valuable works on experimental and applied psychology.

The board of trustees of Teachers College, Columbia University, has approved the proposal to endow a scholarship or fellowship in the college to the memory of "Naomi Norsworthy, a woman of the finest personality, a scholar of exceptional ability, and a teacher of surpassing merit."

At the recent meeting of the department of superintendence of the National Education Association held in Kansas City Dr. Thomas E. Finnegan, deputy commissioner of education of the State of New York, was elected president for the ensuing year. The next meeting will be held at Atlanta, Georgia.

A leave of absence for the first half of the academic year, 1917-18, has been granted to Assistant Professor Walter Fenno Dearborn, of the department of education of Harvard University.—*School and Society*.

In the department of education at Smith College, Assistant Professor H. G. Townsend has been advanced to the grade of associate professor, and Dr. Edna A. Shearer to the grade of assistant professor.—*School and Society*.

Dr. Marion R. Trabue has been appointed assistant professor of education in Teachers College, Columbia University.

PUBLICATIONS RECEIVED

BENJAMIN F. ANDREWS. *Registration and Student Records for Smaller Colleges*. Bulletin, 1916, No. 33. Washington: Bureau of Education, 1916. Pp. 67. Ten cents.

A general consideration of the problem of keeping student records is followed by specimen blanks for use before entrance, at entrance, and during the college course.

EDNA BRYNER. *Dressmaking and Millinery*. Cleveland: The Survey Committee of the Cleveland Foundation, 1916. Pp. 133. Twenty-five cents.

The report considers work for women in the sewing trades, the relative importance of these trades, working conditions, wages and character of present day dressmaking, the millinery business and conditions of work in it, the apprenticeship system, and the training given for these trades in the public school. The commission recommends the establishment of a trade school for girls.

EDNA BRYNER. *The Garment Trades*. Cleveland: The Survey Committee of the Cleveland Foundation, 1916. Pp. 153. Twenty-five cents.

The report sets forth the history of the garment trades, describes what the workers do, who they are, what they earn, the regularity of their employment, training and promotion in the industry, and the educational needs of the garment workers. The sewing trades offer the largest industrial opportunity for girls in Cleveland. Many of these girls go to work before completing the compulsory attendance period. A better enforcement of the attendance laws, the reduction of retardation, and the reorganization of the work of the junior high schools are recommended by the survey. The establishment of a trade school for girls is strongly urged.

SAMUEL PAUL CAPEN. *Recent Movements in College and University Administration*. Bulletin, 1916, No. 46. Washington: Bureau of Education, 1917. Pp. 60. Ten cents.

This bulletin gives summaries of the surveys conducted by the Bureau of Education in Iowa, Washington and North Dakota, and excerpts from reports on the College of the City of New York, Smith College and Miami University. There is further a discussion of college entrance requirements, of teachers' pensions, and of various cases involving academic freedom.

The Case of the Julia Richman High School. New York: Public Education Association, 1917. Part I, pp. 20. Part II, pp. 12.

These bulletins set forth an earnest and vigorous plea for the construction of a building to house the seven branches of the school now

scattered over New York City from City Hall to Central Park. They give a good idea of what the girls are now doing and of how much more they might accomplish if they had adequate quarters.

S. A. COURTIS. *Third, Fourth and Fifth Annual Accountings, 1913-1916. and Summary of Tabulations.* Detroit: Department of Coöperative Research, 1916. Pp. 111. Fifty cents.

The interest in the Courtis Standard Tests grows apace. The number of copies sold last year rose well above the half-million mark and went to almost every state in the Union. The tests in English and geometry have been discontinued in their original form and special tests in reading, writing, and composition will be issued this year. We find in the report an important discussion of standards of speed and of accuracy, and the tables of distribution of the class medians furnish valuable material for comparison. Mr. Courtis has also issued a new supervisory graph for series B and a new form of record sheet.

JOHN DEWEY, and others. *Creative Intelligence. Essays in the Pragmatic Attitude.* New York: Henry Holt and Company, 1917. Pp. v, 467. Two dollars.

This is a coöperative attempt to treat from a common point of view a variety of intellectual problems. These problems lie in the domains of philosophy, logic, mathematics, physical science, psychology, ethics, economics, esthetics, and religion. "The significant points of agreement have to do with the ideas of the genuineness of the future, of intelligence as the organ for determining the quality of that future so far as it can come within human control, and of a courageously inventive individual as the bearer of a creatively employed mind." The eight papers which make up the volume are as follows: *The Need for a Recovery of Philosophy*, by John Dewey; *Reformation of Logic*, by Addison W. Moore; *Intelligence and Mathematics*, by Harold Chapman Brown; *Scientific Methods and Individual Thinker*, by George H. Mead; *Consciousness and Psychology*, by Boyd H. Bode; *The Phases of the Economic Interest*, by Henry Waldgrave Stuart; *The Moral Life and the Construction of Values and Standards*, by James Hayden Tufts; *Value and Existence in Philosophy, Art, and Religion*, by Horace M. Kallen. The book sets forth the pragmatic point of view in philosophical questions somewhat as a similar work by seven realists did a few years ago for neo-realism.

AUBREY AUGUSTUS DOUGLASS. *The Junior High School.* Fifteenth Year Book of the National Society for the Study of Education, Part III. Bloomington, Illinois: The Public School Publishing Company, 1916. Pp. 157. Seventy-five cents.

The first chapter of this monograph includes a brief history of the junior high school movement, arguments for and against it, its cost and its present extent. Chapter Two considers the physiological

and psychological characteristics of adolescence and the arguments for and against a special school organization for, and treatment of, the early adolescent. The author thinks there is justification for such a differentiation, although there is such great variability in the chronological age at which pupils arrive at maturity that even if the saltatory theory of mental development is held, methods of instruction should not be radically changed. Chapter Three develops the curriculum of the junior high school, considers typical junior high school curricula and comments on the advantages of the various plans. Chapter Four discusses such administrative problems as the grouping of grades, housing, relation to colleges, securing of teachers, supervised study and the elimination and retardation of pupils. There is a bibliography of twelve pages.

CHARLES REDWAY DRYER. *Elementary Economic Geography*. Cincinnati: American Book Company, 1916. Pp. 415.

This is a fascinating text on the earth and its productivity in relation to man. The first eight chapters, part one, give a survey of human economics and their foundations in nature, while part two deals with the economic geography of the United States. There are numerous maps, diagrams and illustrations that enhance the attractiveness of the text.

CHARLES WILLIAM ELIOT AND ERNESTO NELSON. *Needed Changes in Secondary Education*. Two papers presented at the Pan-American Scientific Congress, Washington, D. C., December 27, 1915. Bulletin, 1916, No. 10. Washington: Bureau of Education, 1916. Pp. 32. Five cents.

The first of these papers, which gives the title to the monograph, has already been issued as an occasional paper by the General Education Board. The paper by Dr. Nelson, who is Director of Secondary Education in Argentina, is on the Secondary School and the University.

JOHN E. EVANS. *The Effect of Distraction on Reaction Time, with Special Reference to Practice and the Transfer of Training*. Archives of Psychology, No. 37, November, 1916. Pp. iii, 106. \$1.00.

This is a curious and rare instance of an American scientific monograph without table of contents, index or other means of orientation. If the hard pressed reviewer will take the trouble to cut the leaves and examine each in detail he will not find the argument difficult to follow, but it is somewhat remarkable that such an elaborate study should be issued without any of the ordinary aids to orientation. Our interest naturally centers in the transfer of training, and the author finds that the ability gained by long practice in simple reaction to one stimulus seems to be transferred bodily when reactions are made

to another stimulus. Practice in reacting to a particular stimulus with a particular distraction aids in reacting to a new stimulus with the same distraction, or to the same stimulus but with different distractions. The subject acquires definite adjustments to the constant conditions of his work. Useless reactions are repressed early in the practice period. Along with this comes a feeling of self confidence and self reliance which stimulate the subject to active interest in the work, and make transfer possible. This ability to ignore the unessential and to subordinate the minor to the major elements of the situation is synonymous with good attention.

SIGMUND FREUD. *Leonardo Da Vinci*. New York: Moffat, Yard and Company, 1916. Pp. 130. \$1.25.

The sub-title of this book is "A Psycho-Sexual Study of an Infantile Reminiscence," and the author works out in great detail and with characteristic ingenuity a theory to account for some of the peculiarities of this great artist and scientist. Taking as a text a casual reference to a childhood memory of a vulture coming down and striking the boy him on the lips, the author builds up an elaborate structure of sexual attitudes to account for both the strength and the weaknesses of the artist's character.

JOSIAH B. GAME. *Teaching High School Latin*. Chicago: University of Chicago Press, 1916. Pp. ix, 125. \$1.00.

The author has endeavored to prepare a practical manual that will meet some of the immediate needs of the young teacher of Latin. Among the topics considered are the significance of Latin in education and in life, classical studies on the defensive, the training of the Latin teacher, English in Latin study, a detailed consideration of the Latin study in each of the four high school years, Latin prose composition, and the classroom equipment for the Latin department. Every Latin teacher should be well acquainted with the contents of this book.

MELVIN E. HAGGERTY, Editor. *Studies in Arithmetic*. Indiana University Studies No. 32, September, 1916. Pp. 110. Twenty-five cents.

In this bulletin Professor Haggerty gives a second report on the use of the Courtis Test, Series B, in twenty-two Indiana cities, Mr. Paul R. Mort reports on the use of the same tests in the rural schools of five counties, Miss Mary A. Kerr on the effects of six weeks daily drill in addition, Mr. Herman Wimmer on the effects of drill in both fundamentals and reasoning as measured by the Courtis Tests, Series A, and Miss Flora Wilber reports experiments with the Courtis Practice Pads. In the comparison of drill for speed with drill for accuracy the speed group showed the greater gain in all respects when accuracy alone was considered.

LUDOVIC HALEVY. *L'Abbé Constantin*. Edited with notes by Victor E. Francois. Cincinnati: The American Book Company, 1917. Pp. 285.

An interesting story for second or third year French. The text is richly illustrated with quaint old-fashioned pictures.

G. V. HAMILTON. *A Study of Perseverance Reactions in Primates and Rodents*. Behavior Monographs, Volume III, No. 2, 1916. Pp. iv, 65. Seventy-five cents.

This is a continuation of the author's previous study of choice reactions in escaping from an enclosure. The present study was made on one mouse, five gray rats, four black rats, eight white rats, six gophers, four monkeys, one baboon and twenty girls, the latter ranging in age from three to twelve years. The author analyzes the responses into five different types. In regularity and system of attacking the problem the girls stand first, followed by the monkeys and the white rats. The author finds that a response which has been frequently manifested with invariable advantage is more apt to recur in the behavior of the individual than is a still more frequently manifested response which has not brought invariable advantage. As we descend in the phyletic scale the factor of recency seems to increase in importance as a determinant of habit formation, whilst that of frequency relatively decreases.

JAMES H. HARRIS AND H. W. ANDERSON. *Measuring Primary Reading in the Dubuque Schools*. Dubuque, Iowa, 1916. Pp. 23.

This is a report on an experiment to determine the relative values of three different systems of teaching reading. The tests used were the Courtis reading tests for silent reading, and for oral reading the Gray standardized reading paragraphs as used in the Cleveland Survey. There was a decided advantage in favor of one of the systems and this according to the authors was due not to the superiority of the teaching but to that of the methods used. It furnishes a good illustration of how standard measurements may be employed to help solve practical problems of school administration.

JAMES H. HARRIS AND H. W. ANDERSON. *A Study of Handwriting in the Public Schools of Dubuque, Iowa*. Dubuque: Bureau of School Measurements, 1916.

The pamphlet gives an account of the use of the Ayres Handwriting Scale to determine how the pupils of the Dubuque Schools compared with those in other cities. Tables of individual differences and grade differences for both speed and quality are presented, and a comparison is made between the showings in February and June of the same year. The comparison showed a distinct loss in speed in every grade and a slight gain in quality in perhaps half of the grades. The authors claim, however, that the gain in quality is not sufficient to justify the great loss in speed.

ARTHUR W. KALLOM. *English. Determining a Standard in Accurate Copying.* Boston: Department of Educational Investigation and Measurement, Bulletin No. 6, 1916. Pp. 25.

A printed paragraph of simple prose was assigned to be copied by over four thousand first year pupils in Boston high schools. The errors were tabulated according to spelling, capitalization, omitted words, added words, words wrongly used, misplaced words, punctuation, undotted "i's," uncrossed "t's." There is a detailed study of the distribution of errors according to sex, according to the lines written, and according to age. The highest number of errors was found in omitting the dot from the "i," next came errors of punctuation, and errors of spelling made a close third. The girls copied three per cent. more than the boys in the time allowed, and made 66 per cent. fewer errors. Every word in the selection was misspelled by some pupil. Children who wrote fewer lines made relatively as many errors as others. There was little relation between age and ability to copy.

W. E. MACPHERSON. *The Ontario Grammar Schools.* Bulletin of the Departments of History and Political and Economical Science in Queens University, Kingston, Ontario, No. 21. October, 1916. Pp. 22.

An interesting historical sketch of the development of secondary schools in Ontario.

National Society for the Study of Education, Sixteenth Yearbook. Part I. Bloomington, Illinois: Public School Publishing Company, 1917. Pp. 204. Ninety cents.

This yearbook contains the second report of the committee on minimum essentials in elementary school subjects. The first report of this committee appeared in Part I of the Fourteenth Yearbook of the Society. Among the papers to be found in the present volume are *The Relation of Silent Reading to Economy in Education*, by William S. Gray; *Handwriting*, by Frank N. Freeman; *A Suggested Minimal Spelling List*, by Hugh Clark Prior; *Minimal Essentials in Elementary Language and Grammar*, by W. W. Charters; *Economy of Time in Arithmetic*, by Walter S. Monroe; *The Social and Business Use of Arithmetic*, by G. M. Wilson; *United States History as Taught in the Seventh and Eighth Grades*, by W. C. Bagley; *Possible Defects in the Present Content of American History as Taught in the Schools*, by Ernest Horn; *A Scale for Measuring Results of Physical Education*, by Louis W. Raper. Many of these studies present new experimental material and are worthy of careful consideration.

CLARA A. PEASE. *A First Year Course in General Science.* New York: Charles E. Merrill Company, 1915. Pp. 315.

In attacking the subject of science this author begins with the consideration of the heavenly bodies, particularly the sun, moon and planets. There follow chapters on matter, force, heat, liquids, gases,

the weather, light, electricity, minerals, soil, mountains, earthquakes, rivers, glaciers, and the discussion concludes with five chapters on living substance as exemplified in plants and animals. The book also has bound with it a forty-page laboratory manual.

HARRY BRADLEY SMITH. *Establishing Industrial Schools*. Boston: Houghton Mifflin Company, Riverside Educational Monographs, 1916. Pp. xxiv, 167.

The author first considers the problems arising in connection with selecting the type of school for the community. The study of the industries of the community, the number of young people employed, opportunity for advancement in the trade, and allied industries should be carefully considered. This calls for an industrial and educational survey of the community, for making which detailed plans are furnished. Then comes the problem of selecting the course of study. This selection will depend largely on the needs of the community as indicated by the survey, and by the facilities and equipment which the school has at its command. Finally, there is an interesting series of comments on the hap-hazard way in which teachers have often been selected, and on the criteria of a desirable teacher. The author is strongly convinced of the efficacy and beneficent influence of industrial schools, though he has little to say about the cost of their maintenance.

LORLE IDA STECHER. *The Effect of Humidity on Nervousness and on General Efficiency*. Archives of Psychology, No. 38. December, 1916. Pp. v, 94. Ninety cents.

This is a part of the extensive study of the subject of ventilation carried out by the New York State Commission on Ventilation. Almost one-third of the monograph is devoted to a history of investigations of the effect of indoor and outdoor atmospheric conditions. Experiments were made with twenty-nine subjects under various conditions of humidity on accuracy of movement, speed of tapping, speed and accuracy in aiming, typewriting, mirror tracing, hand and arm steadiness, addition, and mental multiplication. The results of the experiments were entirely negative, for experimental humidity conditions considerably more rigorous than those obtaining in any artificially heated apartment produce no demonstrable effect in behavior.

ALBERT AUGUSTUS TREVER. *A History of Greek Economic Thought*. Chicago: University of Chicago Press, 1916. Pp. 162. Seventy-five cents.

A detailed analysis of the writings of Plato, Xenophon, Aristotle, and other Greek thinkers on the subject of economic theory. The book is a striking re-interpretation of Greek economic thought in the light of modern humanitarian economy. The author brings out the remarkable fact that the Greeks were the forerunners of the moral, humanitarian and social emphasis in present day economy. It is an extremely interesting and stimulating study.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A STUDY OF THE ATTAINMENTS OF PUPILS IN UNITED STATES HISTORY

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The study of the ability of pupils in history might be undertaken from several different points of view. We might, first, endeavor to determine the ability to understand present events in the light of the past. This conception of historical ability is one that is frequently proposed in the discussion of the aims of studying history, but it is so vague, so ill-defined that it would be difficult to subject to scientific examination.

In the second place, a more intelligible and scientifically acceptable use of the term historical ability is skill in sifting and evaluating a mass of miscellaneous materials, such as newspaper stories, contemporary documents, hearsay reports, partisan attacks, and special pleadings, and constructing from this confused tangle a straightforward and probable account of a series of events in their causal and consequential relationships. It is this type of ability which is the goal of modern historical scholarship, and its cultivation is striven for by many able and earnest college teachers of history. The extent to which such ability can be developed, and the processes whereby this development takes place, would constitute highly interesting objects of experimental investigation.

Third, a much more modest conception of historical ability is that shown in the appreciation and comprehension of a simple historical narrative, with such an understanding of the interplay of forces depicted in it that a lively realization of the probable

outcome of the series of events would be aroused in the pupil's mind. This is the dominating idea in Kelley's test of historical ability,¹ in which he presents some paragraphs from an account of the unification of Italy, and asks the pupil, first, to tell what was probably the next important event, second, to describe the character and appearance of the hero of the passage, and third, to give as detailed an account of the story as possible.

Fourth, historical ability may be evinced by reflective and discriminating replies to "thought questions" on a given historical situation. This type of test has been used by Buckingham² in his study of the connection between ability to think and ability to remember. The thought questions were based on a brief quotation, a series of statements regarding historical facts, or a series of reasons alleged for the truth of a given statement, and the task confronting the pupils was to answer questions propounded in regard to the passage, to rank the events in the order of their importance, or to indicate by a check mark the reasons which the pupils considered cogent.

In the fifth place, history ability may be taken as the readiness with which pupils answer questions revealing the range of their historical information. This is perhaps the narrowest, and in the estimation of some writers, the least important type of historical ability, but it is the one which is the most readily tested, and was, therefore, chosen for study in the present investigation. Moreover, from the report of Buckingham, just quoted, it would appear that readiness of historical information is rather highly correlated with historical reflection and appreciation, as revealed by the answers to "thought questions." The regression coefficient of such historical "information questions" on "thought questions" was .89. It may be assumed, therefore, with a high degree of justification, that ability in responding to tests of historical facts is a fair index of general historical ability. The general problem of the present inquiry was, "What will a carefully constructed information test in United States history reveal regarding individual, sex, and school differences?"

¹TRUMAN L. KELLEY. *Educational Guidance. An Experimental Study in the Analysis and Prediction of Ability of High School Pupils.* Teachers College, Columbia University, Contributions to Education, No. 71. 1914, page 33.

²B. R. BUCKINGHAM. *Correlation Between Ability to Think and Ability to Remember, with Special Reference to United States History.* School and Society, Volume 5, 1917. Pp. 443-449.

THE QUESTIONS

In selecting the questions for such a historical information test it would be desirable to have the opinions of a large number of competent judges, as high school teachers of United States history, on the relative rank in importance of the data which are included in the teaching of this subject. To secure this ranking would require an extended investigation on its own account, and in the absence of any objective basis the authors, in choosing questions for the present study, were obliged to rely upon their own opinions, supplemented by the advice of several high school and college teachers of history. They endeavored to secure questions that would range from easy to difficult, that would touch upon as many different phases of history teaching as possible, that could be answered briefly, that would afford answers easily scored as right or wrong, and that could be attempted by all pupils in the thirty-minute period ordinarily given to history in the elementary schools, or the forty-minute period of the high schools. After extended discussion and experimentation the following groups of questions were decided upon: I. Give the reason for the historic importance of each of ten representative dates (Dates-Events). II. Indicate for what each of ten prominent men was celebrated (Men-Events). III. Mention the name of the man prominently connected with each of ten historic events (Events-Men). IV. Define in a short sentence each of ten historic terms (Historic Terms). V. Make a list of all the political parties that have arisen in the United States since the Revolution, and state one principle advocated by each (Political Parties). VI. Indicate the great divisions or epochs of United States history (Divisions of History). VII. On an outline map of the United States (supplied) draw the land boundaries of the United States at the close of the Revolution, and indicate the different acquisitions of territory since that date (Map-Study). The questions were as follows:

I. Dates-Events. (Four minutes)

1. 1861.
2. 1789.
3. 1620.
4. 1565.
5. 1898.
6. 1619.
7. 1783.
8. 1492.
9. 1776.
10. 1846.

II. Men-Events. (Five minutes)

1. John Burgoyne.
2. Alexander Hamilton.
3. Jefferson Davis.
4. Walter Raleigh.
5. John C. Calhoun.
6. Cyrus H. McCormick.
7. George Dewey.
8. Sam Houston.
9. Roger Williams.
10. James Oglethorpe.

III. Events-Men. (Three minutes)

1. Captured Quebec during French and Indian War.
2. Discovered the North Pole.
3. Wrote the Declaration of Independence.
4. Invented the telephone.
5. Brought about the Missouri Compromise.
6. Captured the City of Mexico during the Mexican War.
7. Founded the Colony of Maryland.
8. Made a great speech against the English Stamp Tax.
9. Was President of the United States during the Civil War.
10. Vetoes the re-chartering of the United States Bank.

IV. Historic Terms. (Seven minutes)

1. Second Continental Congress.
2. Lewis and Clark expedition.
3. Articles of Confederation.
4. Sherman Anti-trust Law.
5. Monroe Doctrine.
6. Fugitive Slave Law.
7. Dred Scott Decision.
8. Alien and Sedition Laws.
9. Nullification Ordinance of South Carolina.
10. Emancipation Proclamation.

V. Political Parties. (Five minutes)

VI. Divisions of United States History. (Five minutes)

VII. Map-Study. (Five minutes)

The first four groups of questions were given to all pupils; groups V to VII were omitted with the elementary school pupils.

SOURCES OF THE DATA

Material was secured from a senior, a junior, and a freshman class in the University of Texas; from the senior, junior and freshman classes of two Texas State Normal Schools, the Sam Houston Normal Institute, at Huntsville, and the South-West

Texas State Normal, at San Marcos; and from the high and elementary schools of five Texas public school systems, as follows: Austin, Elementary (Winn School), Grades V-VII, High, Grades VIII-XI; Brenham, Elementary, Grades V-VII, High, Grades VIII-XI; Houston, Elementary (Austin School), Grades V-VII, High, Grades VIII, Low X, and XI; Huntsville, Elementary, Grades V-VII, High, Grades VIII-X; and San Marcos, Elementary, Grades VI-VII, High, Grades VIII-XI.

The senior class in the University of Texas was composed of students who were taking work in practice teaching preparatory to teaching in the high school. It was, therefore, a selected group. All the members of it had had courses in history, and many of them had specialized in history in the university. Both on this account and on account of their greater scholastic maturity they might have been expected to make the best showing of any of the classes examined, yet they were surpassed by both the other university classes, and by two classes in one of the normal schools. The freshman class was a class in education composed of students who had formally stated in writing before being allowed to enter the class that it was necessary for them to leave college and teach at the end of the academic year. One of these students made the highest score attained in the tests. The junior class was likewise a class in education, and made the highest average score of any group tested, except one of the normal school groups.

The work of the Texas state normal schools was at that time practically equivalent to the work of the last three years of the average high school. (It has since been materially modified.) The students, however, were somewhat more mature, and since they were definitely preparing to teach, took a slightly different attitude toward the work. Opportunity is given for a full year's work in United States history in the normal, and many of the students have had as much as three years' work in history.

The elementary schools examined had only seven grades, and the high schools comprised grades eight to eleven. This is generally the case in Texas public schools. Supplementary reading books of a historical nature are used in the fourth and fifth grades, and in the sixth or seventh grade a half year is devoted to Texas history. United States history is systematically studied in the eighth year, with a review in the tenth or eleventh year in con-

nection with civics. All the elementary schools were divided into low and high sections, with semi-annual promotions, but this was neglected in grouping the results. The Austin and Houston high schools also have low and high sections reciting in separate classes, but their results have been grouped together. There was no eleventh grade class available in the Huntsville high school, and no results were secured from the ninth or high tenth grades of the Houston high school.

ADMINISTRATION OF THE TESTS

All the tests were given in person by one of the authors (McCollum).³ Printed slips with the questions for each set of tests were fastened together in bundles, and one of these was placed face down on the desk before each pupil. On the back of the bundle the pupil wrote his name, class, school, the amount of history he had previously studied, and the school years in which this study had occurred. The directions for each set were given orally, and were repeated until all understood what was to be done. Some teachers were inclined to doubt whether enough time was allowed for some of the tests, but after they saw the tests given they agreed that the time was ample.

SCORING AND TABULATING THE RESULTS

Papers were obtained from over fifteen hundred students. Some papers were discarded as defective, and exactly fifteen hundred were tabulated. Each question in the first four groups was given a value of ten, and a perfect score on the whole group thus amounted to one hundred. The original plan of counting each answer right or wrong was soon found to be undesirable, and approximations to a correct answer were assigned a proportionate value. In answer to the question on political parties it was rare to find more than five or six parties mentioned, so it was decided to give a rating of five for each party correctly named, and five for the mention of one principle advocated by the party. The highest score obtained by anyone on this question was ninety-five, with perhaps a half dozen scores in the eighties, so that in computing percentages 100 was arbitrarily taken as a perfect score. The answers to the questions on

³ This was made possible in the case of the two normal schools and four of the city school systems through the kind interest and coöperation of Professor L. W. Sackett, of the Department of Education, University of Texas.

Divisions of United States History and on the acquisitions of territory were each evaluated quite arbitrarily on the basis of 100. Since the same examiner marked all the papers it was thought that sufficient uniformity would be gained in this manner.

From the data given by the pupils regarding their previous study of history an attempt was made to record the amount of time that had been devoted to the subject by each pupil, and the recency of this study as indicated by the time that had elapsed between the last study of history and the writing of the test paper. The results were tabulated, and are presented in the first two columns of Table I for what they are worth. The authors do not place great confidence in the figures, for the information was very carelessly and fragmentarily given, the pupils suffered from lapses of memory, and some included the study of any and all history while others confined themselves to United States history.

The answers of the pupils to each question were tabulated on large sheets of cross section paper, with a vertical column to each question, and the results for each pupil were entered on one horizontal line. After each group of questions a column was left for the "Sum," and on the extreme right a double column was marked "Total" (maximum 700). This "total" score divided by the maximum (400 for the elementary schools) gave the individual index for each pupil on the entire test. The percentile distribution of these indices in each class is given in Table II.

In tabulating the results the records of the boys and girls of each half grade (or each entire grade, where there were no half grades) were tabulated separately in order to bring out any sex differences. Since there was a marked and constant sex difference, and since the girls of a given grade usually outnumbered the boys, it was obvious that a better indication of the central tendency of a class or group of classes would be secured by finding the average performance for the boys and girls separately, and combining these averages directly, rather than adding the individual scores and dividing by the total number. This in effect treats the classes as though they were composed of an equal number of boys and girls, or reduces the results for each sex to the basis of 100.

ANALYSIS OF THE RESULTS

The combined results by schools and classes, expressed in percentages of correct replies to each question, are presented

TABLE I
General Results

	Yrs. of Hist. Study	I. Dates-Events										II. Men-Events												
	Recency	1861	1789	1620	1565	1898	1619	1783	1492	1776	1846	Ave.	Burgoyne	Hamilton	Davis	Raleigh	Calhoun	McCormick	Dewey	Houston	Williams	Oglethorpe	A. a.	
34 U. of T. Seniors.....	1.7	5.	76	29	65	9	51	23	25	100	82	11	47	32	49	90	79	53	25	66	82	30	44	55
14 U. of T. Juniors.....	1.5	6.	71	43	66	36	75	14	49	93	93	34	59	52	59	73	64	60	23	77	100	60	82	65
27 U. of T. Freshmen.....	1.5	2.6	76	37	59	30	61	28	53	100	87	37	56	52	59	73	64	60	23	76	86	56	44	59
40 S. H. N. I. Seniors.....	1.7	1.4	73	22	63	32	74	31	41	98	92	41	57	49	30	81	71	59	8	69	86	55	62	58
22 S. H. N. I. Juniors.....	1.5	1.1	56	7	36	22	34	16	10	100	75	31	39	26	32	66	52	40	26	56	72	26	53	44
40 S. H. N. I. Freshmen....	1.1	1.3	50	0	34	15	22	34	5	96	56	10	32	26	21	39	39	31	2	30	67	35	48	34
48 S. W. T. S. N. Seniors....	2.5	1.5	62	67	54	42	53	28	49	93	80	31	55	73	78	76	63	67	29	70	81	37	59	62
29 S. W. T. S. N. Juniors....	1.8	2.4	83	85	74	70	90	74	81	96	95	51	78	78	65	89	77	84	73	94	91	92	89	79
28 S. W. T. S. N. Freshmen	1.5	1.7	53	26	38	30	53	32	25	89	69	33	45	38	36	61	54	55	51	58	75	46	42	52
64 Austin, Grade XI.....	1.3	2.3	73	12	33	12	53	14	30	100	73	34	44	33	39	64	76	69	14	64	84	24	18	48
58 Austin, X.....	1.2	1.3	56	17	20	10	50	11	24	97	62	24	36	33	31	60	47	58	6	63	68	31	24	41
42 Austin, IX.....	1.4	.5	46	10	14	13	53	1	21	97	60	20	34	24	20	48	50	36	3	58	77	41	44	40
52 Austin, VIII.....	1.1	0	20	5	14	24	29	0	13	97	49	12	25	21	14	25	40	39	7	34	53	16	22	39
8 Brenham, XI.....	1.4	1.5	33	49	33	13	33	58	50	100	25	46	45	51	95	34	77	52	59	40	54	67	48	59
12 Brenham, X.....	1.1	.7	47	25	2	17	47	24	15	90	57	17	33	37	71	63	59	42	40	42	72	48	27	42
11 Brenham, IX.....	1.1	1.5	32	17	7	4	48	7	28	84	54	24	30	10	9	58	41	7	0	45	77	40	29	32
27 Brenham, VIII.....	1.0	.5	33	14	20	16	25	8	22	76	32	16	26	26	6	42	47	26	5	42	56	23	19	30
69 Houston, XI.....	1.9	3.2	52	63	49	9	66	2	25	93	76	27	48	33	78	67	64	61	7	73	92	31	33	76
31 Houston, X.....	1.1	2.0	38	19	15	6	60	0	44	98	51	6	34	9	21	52	51	21	6	71	85	19	30	36
86 Houston, VIII.....	1.0	0	38	19	22	12	44	16	14	78	56	15	30	38	66	43	55	29	6	47	88	48	38	46
13 Huntsville, X.....	1.3	3.2	47	0	5	5	68	5	22	100	45	38	34	13	19	60	68	79	0	73	88	48	46	49
21 Huntsville, IX.....	1.4	2.4	23	0	3	0	30	0	0	97	75	13	23	5	5	37	67	29	0	35	70	10	4	26
32 Huntsville, VIII.....	1.8	0	36	4	5	13	29	18	3	85	42	9	24	14	12	43	59	26	0	43	86	39	45	35
10 San Marcos, XI.....	1.6	.9	46	24	69	0	34	45	86	100	86	17	51	56	44	50	68	49	22	44	55	37	40	46
23 San Marcos, X.....	1.4	3.0	49	8	41	9	61	9	49	96	91	25	48	17	31	54	62	48	23	58	78	41	38	45
32 San Marcos, IX.....	1.3	2.0	52	7	27	15	56	0	37	94	69	10	37	15	21	51	50	38	5	44	79	26	33	36
77 San Marcos, VIII.....	1.3	1.1	42	2	26	11	37	2	48	98	47	9	32	9	8	33	46	35	4	31	80	26	25	28
42 Austin, VII.....	.5	0	28	0	6	3	17	0	1	83	24	6	16	0	0	20	34	18	3	30	46	0	8	16
36 Austin, VI.....	0	0	16	2	5	2	24	1	0	52	23	6	13	0	0	20	30	4	7	35	61	0	1	16
36 Austin, V.....	0	0	5	0	32	0	13	0	0	64	5	0	12	2	0	7	28	2	0	7	34	8	19	11
56 Brenham, VII.....	1.0	0	27	7	8	14	24	0	6	93	38	26	25	34	17	38	73	28	20	20	60	28	23	34
41 Brenham, VI.....	.5	0	27	0	4	2	22	4	2	98	47	27	23	3	1	34	47	7	2	19	71	18	13	21
20 Brenham, V.....	.7	0	0	0	1	1	22	0	0	88	18	11	15	0	0	6	35	5	0	5	40	6	21	11
42 Houston, VII.....	.5	0	25	0	4	0	25	1	0	92	30	21	19	5	10	18	35	11	0	19	84	3	5	19
42 Houston, VI.....	.2	0	10	0	7	0	16	0	5	47	17	3	11	1	0	17	35	10	0	20	65	4	10	16
49 Houston, V.....	0	0	6	0	3	0	7	0	0	19	5	2	4	5	0	6	41	8	0	14	55	9	9	15
34 Huntsville, VII.....	1.5	0	19	11	4	16	12	19	10	94	42	15	24	55	47	13	58	53	17	13	71	48	46	42
39 Huntsville, VI.....	.3	1.5	35	0	0	3	0	6	0	100	35	23	20	0	0	25	40	0	0	0	90	9	0	17
44 Huntsville, V.....	0	0	9	0	2	0	3	0	0	90	7	2	10	0	0	0	84	0	0	2	38	0	6	13
32 San Marcos, VII.....	1.2	0	9	12	25	23	18	3	1	86	58	10	25	37	60	14	45	38	0	15	71	29	21	31
13 San Marcos, VI.....	1.0	0	21	11	0	6	29	0	0	82	19	33	20	16	10	11	59	22	0	29	71	47	29	29

TABLE I (Cont.)

	III. Events-Men										IV. Historic Terms										V VI VII					
	Quebec	North Pole	Decl. Ind.	Telephone	Missouri Comp.	Mexico City	Maryland	Stamp Tax	Civ. War Pres.	U. S. Bank	Ave.	2nd Cont. Cong.	Lewis & Clark	Art. of Confed.	Sherman Law	Monroe Doct.	Fug. Slave	Dred Scott	Alien & Sed.	Null. Ord.	Eman. Proc.	Ave.	Pol. Parties	Hist. Per.	Map	Total %
34 U. of T. Seniors.	34	59	75	18	9	18	26	24	91	12	37	28	64	44	11	58	58	24	5	60	36	27	58	39	42	42
14 U. of T. Juniors.	39	61	69	34	29	21	34	43	86	43	46	21	66	63	35	73	69	39	26	31	67	50	32	74	57	55
27 U. of T. Freshmen.	41	76	63	37	33	22	28	31	91	26	45	43	41	59	20	76	72	50	21	10	73	46	40	67	47	51
40 S. H. N. I. Seniors.	51	81	68	8	29	17	25	37	88	23	43	13	35	32	18	53	49	33	3	5	45	31	30	53	30	43
22 S. H. N. I. Juniors.	49	79	76	23	29	16	18	48	79	6	42	13	35	32	18	53	49	33	3	5	45	31	30	53	30	43
40 S. H. N. I. Freshmen	21	75	61	4	18	10	19	23	51	25	32	11	35	15	15	30	24	27	23	1	15	20	20	12	32	34
48 S. W. T. S. N. Seniors	68	82	81	21	34	4	38	26	75	18	45	62	40	84	28	69	62	33	6	2	38	63	43	58	42	49
29 S. W. T. S. N. Juniors	93	93	89	49	71	63	67	64	86	31	71	71	76	68	89	52	84	71	71	65	38	63	49	73	55	68
28 S. W. T. S. N. Fresh.	39	87	68	23	24	31	29	30	66	16	43	30	42	23	26	55	50	46	26	21	25	36	32	53	42	40
64 Austin, Grade XI.	48	92	51	40	12	16	11	13	83	8	37	20	39	54	36	59	44	29	5	4	43	33	31	28	19	35
58 Austin, X.	48	82	53	22	11	16	0	18	70	23	34	19	29	53	28	38	64	29	5	1	34	28	34	35	15	31
42 Austin, IX.	28	90	43	13	27	14	8	29	72	3	32	7	17	26	18	50	54	47	4	3	11	23	27	36	33	30
52 Austin, VIII.	21	77	40	16	14	7	7	23	52	3	26	10	26	21	11	40	24	16	4	2	17	19	20	26	20	22
8 Brenham, XI.	9	69	75	25	34	42	42	0	59	65	44	51	45	51	9	58	73	89	40	35	39	37	28	47	26	37
12 Brenham, X.	0	73	20	20	35	30	52	20	89	42	38	47	39	47	0	48	59	67	5	10	53	37	34	33	37	36
11 Brenham, IX.	23	66	23	7	17	17	23	75	0	37	0	58	23	0	32	19	12	20	4	22	19	21	34	32	26	26
27 Brenham, VIII.	21	76	21	23	21	13	13	23	54	16	29	21	49	10	8	45	42	25	8	2	40	25	21	32	23	26
69 Houston, XI.	55	96	55	48	23	22	10	35	82	5	42	20	32	56	34	73	44	16	9	4	58	35	37	32	41	41
31 Houston, X.	21	91	39	31	0	11	4	7	83	15	31	1	35	4	34	41	24	6	1	2	38	19	23	41	26	32
86 Houston, VIII.	43	86	57	42	13	22	26	41	65	9	40	16	25	30	8	34	25	9	4	4	27	19	21	37	28	32
13 Huntsville, X.	50	58	69	17	0	22	10	39	85	0	45	5	32	21	17	49	34	3	0	2	42	20	18	37	32	32
21 Huntsville, IX.	26	84	26	0	7	0	0	23	52	0	22	1	25	0	2	7	16	5	3	0	26	8	10	19	18	18
32 Huntsville, VIII.	54	79	56	4	8	7	18	27	59	2	32	17	37	1	8	22	26	15	3	3	10	14	12	14	22	22
10 San Marcos, XI.	62	99	100	7	24	17	72	48	93	0	53	28	18	32	27	37	33	12	7	7	47	28	27	25	37	38
23 San Marcos, X.	51	91	93	61	14	34	23	37	96	5	50	18	43	30	26	61	52	19	1	4	37	32	32	32	30	36
32 San Marcos, IX.	40	77	50	17	17	20	13	36	64	10	34	13	39	29	16	29	18	20	2	8	38	21	23	21	25	28
77 San Marcos, VIII.	29	71	50	12	8	14	7	25	61	5	28	7	40	8	5	35	29	23	8	3	19	16	16	19	21	23
42 Austin, VII.	9	65	8	5	0	0	0	3	37	0	13	0	11	0	2	0	3	0	0	0	10	3				12
36 Austin, VI.	12	41	2	3	0	0	5	7	22	4	10	1	7	0	2	3	0	0	0	0	33	5				11
36 Austin, V.	14	17	0	0	0	0	1	18	10	0	6	0	8	0	0	0	0	0	0	0	0	0				8
56 Brenham, VII.	18	65	52	32	14	28	16	25	51	22	32	19	30	19	4	20	24	7	10	11	7	15				27
41 Brenham, VI.	6	91	20	3	2	2	19	18	51	0	21	2	5	8	12	8	1	5	0	0	5	5				18
20 Brenham, V.	0	67	0	0	0	0	15	0	9	0	9	0	0	0	0	5	0	0	0	0	0	1				9
42 Houston, VII.	13	84	20	6	0	6	4	3	56	0	20	1	13	0	7	0	6	2	1	0	19	5				15
42 Houston, VI.	0	78	19	3	0	4	7	3	38	0	15	0	6	0	4	0	3	0	0	0	13	4				12
49 Houston, V.	7	53	8	11	0	4	0	8	35	0	13	0	8	0	0	0	0	0	0	0	3	1				8
34 Huntsville, VII.	43	62	55	0	38	7	22	62	38	42	36	37	38	47	0	29	20	4	11	33	10	23				31
39 Huntsville, VI.	45	78	3	0	0	0	0	8	13	0	15	0	8	0	0	6	3	0	0	0	4	2				13
44 Huntsville, V.	4	6	24	3	0	0	3	12	6	2	7	0	0	0	0	2	0	0	0	0	0	0				8
32 San Marcos, VII.	10	59	70	0	0	4	20	49	41	0	26	21	58	26	0	4	4	23	4	2	16					25
13 San Marcos, VI.	17	70	48	0	0	0	17	36	53	0	25	0	27	0	0	0	6	0	0	0	3					21

in Table I. In column one is indicated the time in years that the pupil has studied United States history, as computed from his statements on the test sheets. As was said above, these statements were not very satisfactory, and the figures in column one can be taken only in a very general way to indicate the amount of time spent on the subject. As far as they go, they would seem to indicate that there is no connection between the amount of time spent on the study and attainments in the tests, for high school and normal school pupils. This is even more apparent from an examination of the individual records than from the class scores given in the table. Perhaps the reason for longer study on the part of many of the pupils is that they found the subject difficult, and were obliged to take some parts of the work over. This would cause the duller pupils to show the longer time.

It was thought that recency of study of the subject might be associated with higher grades in the tests, and in column two of Table I the interval between the last study of United States history and the date of the tests was estimated from the pupil's statements on the test sheets. While this might account for the relatively low scores of the university seniors, it does not hold at all of the normal and high school pupils, and the university juniors, who claim to be the farthest away from the subject of any group, make almost the best showing. The only general tendency observable is a small, irregular increase in the scores with increasing academic age. Whether this represents the net increment of further study, or comes from broader reading and incidental information is hard to say. Perhaps both factors contribute to the result.

On the whole the university students show the superiority that would naturally be expected of them. In spite of the fact that the seniors do not do as well as the juniors and freshmen, the scores of the university students as a group are higher than those of any other group except the South-West Texas State Normal. The comparison of the two normal schools shows the most striking difference to be found in the whole table. From two schools under the same general control, with practically the same course of study, the same salary schedule, and the same aims, one would scarcely expect to find such a divergence. Immediately rises the query, is the difference due to the conduct of the class work, or to some selective factor affecting the pupils?

There can be little doubt that good class work is done at the South-West Texas Normal. The individual scores, especially of the juniors, run very high, and make a good showing on those questions that indicate a knowledge of constitutional history, as in Group IV, Historic Terms. On the other hand, it will be noted that the two senior classes are not as far apart as the two freshman classes, indicating that with the material available the Sam Houston Normal has done the best work. The ascription of the difference in the showing of the two schools to fundamental differences in pupils is supported by two other considerations. First, San Marcos, the seat of the South-West Texas Normal, is located in the center of a prosperous, intelligent and progressive community, and draws its pupils from homes of the better sort. Huntsville, where the Sam Houston Normal is located, is by no means so favorably situated. Second, a comparison of the results from corresponding classes in the San Marcos and Huntsville high schools shows a similar difference in pupils drawn from those localities but having no connection with the normal schools. Thus the mere difference in final scores does not warrant any conclusions as to the school in which the best work is done.

The final average per cents. of the five high schools are Austin 30, Brenham 33, Houston 33, Huntsville 24, and San Marcos 31. With the exception of Huntsville the schools present about the same general picture—wide variations in the responses to particular questions, but these variations balancing each other. In the elementary schools the final average per cents. are Austin 10, Brenham 18, Houston 12, Huntsville 17, and San Marcos 23. It must be noted that for San Marcos we have only the sixth and seventh grades. Comparison of the results grade by grade shows that Austin and Houston are in the same class and that the other three schools are distinctly in advance, making at least fifty per cent. better showing. Column one, however, shows the reason. In the Austin and Houston schools no work in history is given before the seventh grade, while in the other schools the pupils begin history in the fourth or fifth grade. In view of the fact that pupils who have begun history later make as good a showing in the high school as those who began it earlier (compare Houston with Brenham or San Marcos) it might be argued that the study of history by elementary school pupils is

a waste of time. The case, however, is by no means so simple. The high schools of Houston and Austin have the reputation of being very well administered and of having an exceptionally high grade of teachers. If the other cities had as well organized and equipped high schools perhaps their pupils would have made a better showing. Surely a grade of 33 in 100 on the simplest and most obvious facts of American history is not a record in

TABLE II.
Percentile Distribution of Individual Scores

	Lowest	10%	20%	30%	40%	50%	60%	70%	80%	90%	Highest	Ave.
34 U. of T. Seniors.....	18	20	28	38	42	43	44	48	51	61	73	42
14 U. of T. Juniors.....	18	27	35	43	53	56	63	67	74	78	86	55
27 U. of T. Freshmen.....	16	24	33	39	46	58	63	66	76	78	93	51
40 S. H. N. I. Seniors.....	8	25	28	34	38	40	48	53	58	70	82	42
22 S. H. N. I. Juniors.....	6	13	16	24	27	37	37	39	47	57	68	34
40 S. H. N. I. Freshmen.....	8	9	15	16	17	22	23	28	31	42	68	25
48 S. W. T. S. N. Seniors.....	18	31	33	36	43	45	49	55	62	69	79	49
29 S. W. T. S. N. Juniors.....	20	35	48	59	61	63	75	77	81	84	90	67
28 S. W. T. S. N. Freshmen.....	3	5	9	20	29	34	37	52	63	69	83	39
64 A. H. S., Grade XI.....	11	16	21	22	27	31	34	37	48	55	74	35
58 A. H. S., X.....	3	11	18	22	24	28	33	38	49	54	60	31
42 A. H. S., IX.....	0	15	21	22	25	27	30	33	39	43	62	30
52 A. H. S., VIII.....	3	6	7	12	13	15	20	23	30	41	62	22
8 Brenham H. S., XI.....	20		30		44	45	48		63	72	82	42
12 Brenham H. S., X.....	10	16	17	24	25	26	35	35	39	72	84	37
11 Brenham H. S., IX.....	3	3	8	11	13	16	26	31	36	45	66	26
27 Brenham H. S., VIII.....	5	5	7	8	11	14	22	35	46	51	66	26
69 Houston H. S., XI.....	13	17	25	28	33	40	43	49	53	58	84	41
31 Houston H. S., X.....	11	14	16	18	19	21	24	28	31	34	56	26
86 Houston H. S., VIII.....	4	11	15	18	26	29	35	41	47	57	69	37
13 Huntsville H. S., X.....	8	9	12	14	20	24	25	27	33	45	64	32
21 Huntsville H. S., IX.....	3	3	8	10	12	13	15	17	25	31	43	18
32 Huntsville H. S., VIII.....	6	9	12	13	14	20	23	25	34	38	48	22
10 San Marcos H. S., XI.....	18	18	18	21	32	32	42	45	45	54	63	38
23 San Marcos H. S., X.....	13	13	18	25	30	36	38	40	42	47	68	36
32 San Marcos H. S., IX.....	1	10	13	16	21	22	27	33	41	52	72	28
77 San Marcos H. S., VIII.....	1	6	10	14	18	20	23	27	34	44	67	23
42 Austin, VII.....	0	3	5	7	9	10	12	13	14	19	39	12
36 Austin, VI.....	0	1	3	4	5	8	9	10	13	18	36	11
36 Austin, V.....	0	0	3	3	4	6	7	8	11	14	23	8
56 Brenham, VII.....	5	7	10	13	15	20	23	28	35	48	74	27
41 Brenham, VI.....	6	9	11	13	15	17	20	23	29	32	51	18
20 Brenham, V.....	3	4	5	5	6	6	9	10	10	12	23	9
42 Houston, VII.....	6	7	8	9	11	12	16	18	22	25	36	15
39 Houston, VI.....	0	0	3	5	6	9	10	12	13	20	29	12
49 Houston, V.....	0	1	3	4	4	5	6	7	9	14	42	8
34 Huntsville, VII.....	9	13	19	24	25	27	28	35	40	45	73	31
39 Huntsville, VI.....	2	5	8	12	13	13	15	15	16	20	26	13
44 Huntsville, V.....	0	4	5	5	6	6	8	8	9	13	27	8
32 San Marcos, VII.....	5	5	11	13	17	23	30	32	34	35	44	25
13 San Marcos, VI.....	7	10	10	12	17	18	19	22	25	30	40	21

which any high school can take great pride. Again the mastery of such facts as were involved in this test is only an insignificant part of the value of history for elementary school pupils. Whether any series of tests can bring out this value is a problem for further study.

Table II gives the percentile distribution of the individual scores in each grade or class. The individual score was found by dividing each pupil's total credits times 100 by the maximum. In the table the 34 University of Texas Seniors are seen to have received scores ranging from 18 to 73, with the ten percentile at 20, the twenty percentile at 28, etc. The average in the case of the normal and public school pupils was obtained not by combining the individual scores directly, but by combining the boys and girls separately, and then combining these averages. Since there were always fewer boys than girls, and since the boys usually had the higher scores, the averages are slightly higher than would have been the case if the scores had been combined directly. This accounts in part for the fact that the average is generally higher than the median. In the college classes the boys were so few in number (two in each class) as to be negligible.

Inspection of this table shows a wide range of individual scores in each class. The highest individual score (93) was made by a girl in the university freshman class, and the next highest by a boy in the junior class of the South-West Texas Normal. It is noteworthy that at least two seventh grade pupils made scores as high as the highest made by any university senior.

Of the four principal groups of questions in Table I, Group II (Men-Events) was the easiest, and Group IV (Historic Terms) was the hardest. On the whole, however, the groups were fairly evenly balanced. Taking the combined averages of the 875 normal and high school pupils as a basis the average scores for each group were as follows: I. Dates-Events, 43. II. Men-Events 49. III. Events-Men 41. IV. Historic Terms 32. V. Political Parties 28. VI. Periods of History 40. VII. Map 31. Table III gives the ranking of the first forty questions according to the average of the normal and high school pupils. In parallel columns are given the averages of the combined normal, high and elementary school pupils, and the university, normal, high, and elementary school groups taken separately. This table shows how much and what sort of variation there was in the ranking of the questions according to the returns from each group.

TABLE III.

Ranking of Questions

	875 Norm. & H. S. Av.	1425 Norm. H. S. & El.	75 U. of Tex.	207 Normal	668 High School	550 Elementary
1. 1492.....	95	89	98	96	93	78
2. North Pole.....	82	75	65	83	81	59
3. Houston.....	78	73	52	79	76	62
4. Civil War Pres.....	73	60	89	74	72	33
5. 1776.....	68	53	87	78	58	27
6. Declar. of Independ.....	63	50	69	74	51	25
7. Jefferson Davis.....	60	45	79	71	49	16
8. Raleigh.....	59	54	75	60	57	47
9. Dewey.....	57	43	73	63	51	17
10. 1861.....	55	44	74	65	44	17
11. Monroe Doctrine.....	51	35	69	59	42	5
12. 1898.....	50	39	62	54	46	17
13. Calhoun.....	49	39	60	56	41	16
14. Fugitive Slave Law.....	46	32	66	54	37	5
15. Oglethorpe.....	45	35	57	59	31	16
16. Quebec.....	45	35	38	54	36	14
17. Roger Williams.....	41	33	49	47	34	17
18. Lewis and Clarke.....	39	32	57	44	34	18
19. Articles of Confed.....	37	25	55	46	27	8
20. Burgoyne.....	37	29	45	49	24	13
21. Hamilton.....	36	28	52	44	28	12
22. 1620.....	36	27	63	50	22	8
23. Emancip. Proclam.....	35	26	67	36	34	7
24. 1783.....	32	21	42	35	28	2
25. Stamp Tax Speech.....	32	26	33	38	26	19
26. Dred Scott Decision.....	31	21	38	39	23	2
27. 1846.....	27	22	27	33	20	14
28. 2nd Cont. Cong.....	27	21	31	37	16	6
29. Maryland Colonized.....	26	20	26	33	18	10
30. 1789.....	25	17	36	32	17	4
31. Missouri Compromise.....	25	18	24	35	15	4
32. 1619.....	24	17	22	36	12	3
33. 1565.....	23	17	25	36	10	6
34. Telephone.....	23	15	30	22	23	5
35. McCormick.....	22	16	18	32	11	4
36. Mexico City.....	21	15	20	24	17	4
37. Sherman Law.....	21	14	22	25	16	2
38. U. S. Bank.....	16	12	27	20	11	5
39. Alien and Sedition Laws.....	16	12	17	24	7	5
40. Nullification Ordinance.....	10	7	14	13	6	4

It will be seen that the date 1492 has the highest percentage of correct answers in each of the groups. The dramatic element in the discovery of the North Pole probably accounts for the fact that it comes second with high school children. In this connection it is interesting to note that a large number of Texas children are still inclined to give Cook the credit for that discovery. Where both Peary and Cook were mentioned the full score was given. In perhaps eighty per cent. of the correct answers Peary's name was spelled Perry. That Sam Houston has such a high place on the list is undoubtedly due to the fact that he was the local hero and father of the Texas Republic. Many of the children thought that he captured Mexico City. That Lincoln's name as Civil War President is not more familiar to Texas children is perhaps not surprising. Many gave Jefferson Davis. The fact that 1776 is only a little over half as familiar to high school pupils as 1492 calls for some explanation. In New England or the Atlantic states the score would be higher. Texas children are far from the scenes of the Revolution, and local interest centers in Texas independence rather than in the Declaration of Independence of the colonies. Jefferson Davis was frequently confused with Thomas Jefferson. Raleigh was familiar from the stories in the readers, and Dewey is held in mind as a great naval hero. The Monroe Doctrine was the most familiar of all the historic terms, with the Fugitive Slave Law next. Wolfe and Montcalm were assigned with equal frequency as the captors of Quebec. The Articles of Confederation were ascribed to the Confederacy, and the fact that the Emancipation Proclamation was a war measure and applied only to the states then in rebellion was quite generally overlooked. The uncertainty about the date 1846 is striking, since the war with Mexico was so vitally concerned with Texas. The scores on the invention of the telephone, McCormick, and the Sherman Law indicate how little attention is paid to social and economic development in the teaching of history. The veto of the re-chartering of the United States Bank, the Alien and Sedition Laws, and the Nullification Ordinance of South Carolina are technical points that would scarcely be expected to be very familiar to school children. In general those who answered these questions correctly got high percentages in the totals.

The scores on the question about political parties were remarkably low. Only the South-West Texas Normal, the university

freshmen, and the Houston eleventh grade showed an adequate appreciation of political affairs. The grades on historical periods or epochs were higher, but the divisions of history are so much a matter of individual taste and opinion that the only course left for the examiner was to give a good mark in case a reasonable outline of United States history was given. The map exercise gave a test of territorial history that was very difficult for some, but showed a high correlation with the average ($r = .83$).

SEX DIFFERENCES

Owing to the fact that girls usually get higher school marks in history than boys, and that in co-educational colleges where many elective courses are offered the girls seem to prefer history and literature, the authors expected to find a slight sex difference in these tests in favor of the girls. They were not a little surprised, therefore, to find a constant and marked superiority manifested by the boys. Table IV shows how uniform this tendency is for all classes in all groups of tests, and the detailed tables (which cannot be published here) reveal the same difference in a more extended fashion. The average difference for high school pupils is eight points (Boys 34, Girls 26), or a superiority on the part of the boys of about 31 per cent. For the normal schools the average difference is six points, and for the elementary schools four points. This striking superiority of the boys holds with almost every group on all but a few questions. One of the exceptions was the question on Periods of History, in which, as is shown in the table, the girls were generally superior. Another, curiously enough, was the question which showed the highest frequency of correct answers,—the date 1492. In only nine out of twenty-four high and normal school classes did the boys get a higher score on this date than the girls. All the other dates showed a considerable difference in favor of the boys. Why the girls should do so much better on this one date is a matter for speculation.

In their study of history text-books for elementary schools Bagley and Rugg⁴ gave a list of the men most frequently mentioned, calling it the "Hall of Fame." If we consider all of the men who are at all involved in the answers to our questions, and

⁴ W. C. BAGLEY AND H. O. RUGG. *The Content of American History as Taught in the Seventh and Eighth Grades.* University of Illinois Bulletin, 13: No. 51, 1916.

TABLE IV.
Sex Differences

	Dates-Events	Men-Events	Events-Men	Hist. Terms	Pol. Parties	Hist. Per.	Map	Total %
34 S. H. N. I. Boys.....	35	46	43	25	26	26	27	34
68 S. H. N. I. Girls.....	19	44	35	28	21	53	21	33
31 S. W. T. S. N. Boys.....	45	72	58	54	48	56	53	57
74 S. W. T. S. N. Girls.....	32	57	46	43	34	53	39	47
99 Austin H. S. Boys.....	44	45	37	30	28	28	22	33
117 Austin H. S. Girls.....	30	39	23	23	23	32	15	26
20 Brenham H. S. Boys.....	36	42	39	30	29	33	33	35
38 Brenham H. S. Girls.....	31	39	30	34	22	40	21	31
70 Houston H. S. Boys.....	40	52	42	29	31		29	37
116 Houston H. S. Girls.....	34	54	32	19	23		38	28
20 Huntsville H. S. Boys.....	30	44	34	18	17		36	30
46 Huntsville H. S. Girls.....	23	30	24	10	10		11	18
57 San Marcos H. S. Boys.....	47	48	51	29	24	23	36	37
85 San Marcos H. S. Girls.....	36	29	31	19	19	26	20	25
53 Austin Elem. Boys.....	15	18	12	4				12
61 Austin Elem. Girls.....	12	10	7	2				8
57 Brenham Elem. Boys.....	23	25	22	7				19
60 Brenham Elem. Girls.....	19	19	19	6				16
54 Houston Elem. Boys.....	13	21	22	10				15
79 Houston Elem. Girls.....	9	12	10	3				8
60 Huntsville Elem. Boys.....	17	25	19	9				18
57 Huntsville Elem. Girls.....	19	22	19	11				18
21 San Marcos Elem. Boys.....	26	36	30	10				26
24 San Marcos Elem. Girls.....	19	24	21	9				20
579 Total Boys.....	37	43	37	25	31	35	36	33
846 Total Girls.....	32	35	28	21	24	45	26	27

compare them with Bagley and Rugg's list we find eleven names common to both, i. e., Lincoln, Jefferson, Davis, Monroe, Calhoun, Burgoyne, Hamilton, Henry, Clay, Scott, and Jackson. Ranking these in order according to the results of the two studies we find that Lincoln comes first and Jefferson second on both lists, and that the Pearson coefficient of correlation for the two lists is $r = .52$. The two studies are so entirely different in nature that it is remarkable to find such an agreement existing between them.

SUMMARY

1. Simple questions on fundamental aspects of United States history are answered by high school pupils with 33 per cent. correct responses, by normal school pupils with 43 per cent., and by university students with 49 per cent. The upper three grades of the elementary school have only 16 per cent. correct. This does not show a very thorough mastery of basic historical facts.

2. Each class and group studied shows a wide variation in individual scores, ranging for the better groups from 20 to 90, and for the poorer ones from 0 to 23. Some seventh grade pupils make as good a score as the best university senior.

3. In general the biographical questions are more correctly answered than the dates or the historic terms. The latter set of questions is the more indicative of historical ability.

4. The boys are markedly superior to the girls in almost every class. The amount of this superiority ranges from 4 points (28 per cent.) in the elementary schools to 8 points (31 per cent.) in the high schools. This superiority is seen in the answers to all but a few questions. On the most familiar question, however (1492), the girls show a pronounced superiority over the boys.

5. The average accuracy with which the different questions were answered varies from 95 per cent. (1492) to 10 per cent. (Nullification Ordinance of South Carolina).

6. It would be of interest to have the same questions given in other sections of the country, to determine how different localities compare in the familiarity with basic facts of United States history manifested by public school pupils.

DELAYED RECALL IN HISTORY

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Of the large number of studies on memory, most have been, for obvious reasons, on immediate recall, recall after a few minutes, a few hours, or, at most, a few days. Recall delayed for a longer time has been studied by some writers, such as Norsworthy,¹ 30 days; Henderson,² 28 days; Strong,³ 42 days; Huguenin,⁴ 56 days; Myers,⁵ 3, 4, 6, and 10 months, and 9 and 10 years. Wells⁶ studied the retention of an acquired capacity to tap after five years.

Students of education have for some time realized the need of follow-up tests to determine how much of what is learned in school persists for use in later life. The work of Bonser,⁷ in which grade children once tested for reasoning ability were followed up after about nine years; and that of Bird T. Baldwin,⁸ on physical measurements of the same individuals for about 12 years, are samples of the kind of work greatly needed in other lines.

With a view to make a small preliminary measure of the recall of one-time familiar facts in history after the lapse of a year or more, this study has been made.

At the end of their first year in the Brooklyn Training School for Teachers, and one year from the completion of a course in

¹ NORSWORTHY, NAOMI. *Acquisition as Related to Retention*. 1912, Jr. Ed. Psychol. 3: 214-215.

² HENDERSON, E. N. *A Study of Memory for Connected Trains of Thought*. (Columbia University thesis.) Psychological Monographs, 5: No. 6, Whole No. 23, 1903. Pp. 94.

³ STRONG, E. K. *Effect of Time Interval upon Recognition Memory*.

⁴ HUGUENIN, C. *Revivescence paradoxale*. Arch. de psychol. 1914, 14: 379-383.

⁵ MYERS, G. C. *A Study in Incidental Memory*. Arch. of Psychol. 1913, N. Y. Science Press. No. 26.

A Comparative Study of Recognition and Recall. 1914, Psychol. Rev., 21: 442-456.

MYERS, GARRY C. AND CAROLINE E. *Reconstructive Recall*. 1916, Amer. Jr. Psychol., 27: 493-506.

⁶ WELLS, F. L. *Retention of Acquired Capacities*. Amer. Jr. Psychol. 1915, 26: 58-68.

⁷ BONSER, FREDERICK. *Selective Significance of Reasoning Ability*. Jr. Ed. Psychol., 1916, 7: 187-201.

⁸ BALDWIN, BIRD T. *Physical Growth and School Progress*. U. S. Bureau of Education, Bulletin No. 10, 1914. Whole No. 581, 215 pp.

U. S. history in the high school, 107 girls were asked to state, during a class period of 45 minutes, one important fact of American History which they could associate with the following 50 names: Dewey, John Cabot, King Philip, Eli Whitney, Early, John Jay, Montcalm, Cyrus W. Field, Hamilton, Rosecrans, Samuel F. B. Morse, Balboa, Fulton, "Stonewall" Jackson, McCormick, Sheridan, Schuyler, Martin Van Buren, Burgoyne, Winthrop, John Marshall, Wolfe, Roger Williams, William Lloyd Garrison, Peter Stuyvesant, Zachary Taylor, Shay, Daniel Webster, Burr, Daniel Boone, Bacon, Cartier, Burnside, James Oglethorpe, Schley, Lafayette, Citizen Genet, Stephen A. Douglas, William Penn, Ethan Allen, McDonough, Cornwallis, Drake, Patrick Henry, Robert E. Lee, Calhoun, Jefferson Davis, U. S. Grant, Green, Andros. Emphatic instructions were given to be specific; if it was the name of a general, for example, the war and the side on which he fought should be named; if an explorer, where he explored; if a statesman, the specific movement with which he was identified. Furthermore, they were told not to answer in sentences, but in the fewest possible words, and to designate those names with which they had never been familiar.

RESULTS

	Ave.	Per cent.
Number answers correct.....	22.7	45.4
Number answers partly correct.....	11.4	22.8
Number answers wholly wrong.....	7.5	15.0
Number "answers" not attempted.....	8.4	16.8

No one of the 107 answered all correctly. The highest number of correct answers to the 50 names, by any one individual, was 44; the lowest, 3, with an average of 22.7, M. V. 5.8. The corresponding figures for those answers partly correct were 27, 3, 11.4 and 3.5. Therefore, fewer than one-half the names elicited correct associates. About one-fifth were answered with partial correctness, one-seventh wholly wrong, and one-sixth were not attempted.

At the rate of 2 per cent. for each correct answer, and an estimated proportion thereof for partially correct answers, the average performance by the 107 girls was 58.5 per cent. (The average was computed on the basis of 50 names minus the 2.1 names labeled "never familiar.") A good deal of error is probable in the grading of the *partly correct* answers. However, were they all given perfect scores the average efficiency by the whole

group would be increased *only* by about 10 per cent., making a total of only 68.5 per cent. As it is, the partially wrong answers were graded on the average slightly more than half-correct.

About one name out of 3 either elicited no attempt to answer or a totally incorrect answer, and about one out of 25 was labeled as "never familiar." Thirty subjects reported none as "never familiar"; 24 reported one, and 1 reported fifteen. Assuming that all the names on the average but two were once associated with the correct historical unit, about 40 per cent. was lost between the time of mastery and that of recall.

Of course there is another assumption which is present in practically all educational measurements, namely that what is recalled on demand is a measure of what has been learned. Common sense questions that assumption, and recent experiments make it very doubtful. For example, Myers and Myers found in a study of *Reconstructive Recall*⁵ that as high as 81 per cent. of a given poem, once familiar, was added in recalls subsequent to the first recall, without any relearning, and that "on the average the gain in total subsequent recalls was about half as much as the original selections and about twice as much as the first recall." The writer elsewhere found that of 47 boys "21 gave more words in the second recall (after one hour) than in the first (immediate) recall, with an average of two-tenths of a word more in the second than the third recall." For both sexes from one to six correct words were added (without re-study) in the second or third recall.⁹

Therefore, in measuring for efficiency in any school subject this factor offers a serious difficulty, which one is apt to overlook in interpreting results. A part of the retained but not-recalled elements of those once learned, doubtless function to no small degree in subsequent procedure with the subject in which measurement is attempted, and carry over as common elements to other subjects. Such factors are not readily measurable. Let it be remembered that all types of tests merely measure what at the time can be "cashed in." The results of this study should be considered with this in mind.

In addition to the difficulties already pointed out above it is evident that one has no assurance as to just how many of the

⁹ MYERS, G. C. *Recall in Relation to Retention*. Jr. Ed. Psychol. 1914, 5: 119-130.

names the subjects ever learned in association with the correct historical element.¹⁰ Furthermore, since only a small section of one subject was studied, one cannot infer whether, in relation to retention of other subjects, the performance was relatively good or bad.

All these difficulties granted, the value of measurements on the other hand is not to be greatly depreciated thereby. In the first place, at almost every turn in life one is tested for recall of some past experience to solve a problem on the spot. Frequently one fails to recall the appropriate experience and discovers by later recalls just what was needed to solve the problem then presented. Life, then, is a continuous process of testing, without warning, for delayed recall.

FREQUENCY OF RECALL

Although the 50 names for the test were only arbitrarily selected the order of their familiarity based on correct answers, with approximate per cent. of subjects answering each correctly, will be of some interest. They follow:

Eli Whitney.....	99	Montcalm.....	56	Ethan Allen.....	27
Fulton.....	96	Burgoyne.....	55	Genet.....	26
Zachary Taylor.....	89	Jefferson Davis.....	55	Oglethorpe.....	22
William Penn.....	88	Sheridan.....	52	Rosecrans.....	21
Van Buren.....	85	Drake.....	46	Calhoun.....	21
U. S. Grant.....	85	Hamilton.....	46	Greene.....	21
Balboa.....	83	Dewey.....	46	Schuyler.....	20
John Cabot.....	80	Burr.....	40	Webster.....	20
Stuyvesant.....	79	Garrison.....	40	John Marshall.....	17
Lafayette.....	72	Boone.....	39	Winthrope.....	16
Samuel F. B. Morse..	70	Cartier.....	36	Bacon.....	16
Robert E. Lee.....	68	Jay.....	36	McDonough.....	15
Cornwallis.....	62	Douglas.....	37	Andros.....	15
"Stonewall" Jackson..	60	Burnside.....	32	Schley.....	13
Roger Williams.....	57	Patrick Henry.....	32	Early.....	5
Wolfe.....	57	King Philip.....	32	C. W. Field.....	1
McCormick.....	60	Shay.....	31		

Bagley and Rugg,¹¹ studied the "Content of American History as Taught in the Seventh and Eighth Grades." They analyzed twenty-three representative histories published during the past fifty years, and they present a list of the twenty-five persons in civil life most prominent, and another list of the twenty-five persons in military and naval affairs most prominent, from 1765-1865. Among the names used by the writer there happen to

¹⁰ In another study in progress this difficulty is receiving consideration.

¹¹ University of Illinois Bulletin, Aug. 1916. No. 51.

be ten of those of the civil list of Bagley and Rugg and ten of the military list. (Unfortunately the writer's test was made before the appearance of their work.)

A comparison is given below of the order of frequency for familiarity by the writer's subjects with the order of frequency of appearance of these names in history texts.

*A Comparison with Bagley and Rugg's Lists
Order of Frequency*

Civil List			Military List		
	Bagley & Rugg	Myers		Bagley & Rugg	Myers
Hamilton.....	1	4	Lee.....	1	3
Patrick Henry.....	2	8	Grant.....	2	2
Van Buren.....	4	2	Cornwallis.....	3	4
Calhoun.....	4	9	Burgoyne.....	4	6
Webster.....	4	10	"Stonewall" Jackson... 5.5		5
Douglas.....	6	7	Greene.....	5.5	8
Jefferson Davis.....	7	3	Zachary Taylor.....	7	1
Zachary Taylor.....	8	1	Sheridan.....	8	7
Burr.....	9	5	Schuyler.....	9	9
Jay.....	10	6	Early.....	10	10
Correlation		— .261	Correlation		+ .682

$$r = 1.00 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

It is rather interesting that while the correlation is high for the military list it is practically zero for the civil list. Perhaps the discrepancy may mean that schools vary much more widely in the relative estimates of civil leaders in history than they do upon the warriors.

It would be highly interesting to submit in random order the names of the two lists of Bagley and Rugg to school children from the seventh grade upward from a number of representative schools of the United States, and to submit the same names to the same pupils a few years later.

INCORRECT RECALLS

In addition to the measurement of efficiency in terms of correct and partially correct recall this study reveals some interesting data on the nature of incorrect recall. Let it be noted that all the wrong answers comprised some correct unit of history, but wrongly associated. This fact is too frequently overlooked in practical school work. Likewise in most memory studies the nature of wrong responses has generally been neglected. Among

the first to consider it was Meumann¹² and Kirkpatrick.¹³ The latter noted that for such words as *spool*, *thimble*, and *knife* which had been pronounced, some words as *thread*, *needle*, and *fork* were given in recall. Like phenomena are reported by Peterson¹⁴ in a recent article.

Myers,¹⁵ too, presented considerable data in an analysis of incorrect recalls by 391 subjects for immediate and delayed recall, and, in the March issue of this JOURNAL (p. 166) he devoted an entire paper to "Confusion in Recall."

A few examples in confusion are presented below:

"Stonewall" Jackson—General, Civil War, federal side (3);¹⁵ General during French and Indian War; American General, Mexican War; Pres. U. S. and General, Civil War (4); Fought in New Orleans; Battle of Fredericksburg, American; Commander U. S. Army; Governor of Dutch.

Schuyler—General, French and Indian War; General, Civil War; American General, Civil War; British General in Revolution (2); Civil War Commander; U. S. Leader in Civil War; American Leader, Naval Victory, Spanish American War; Foreigner who fought in America during Revolution.

Burgoyne—Southern General, Civil War; French General in Civil War; General in Civil War (2); General, War of 1812; French General (3); French General surrendered in Revolution; French General, French and Indian War; French and Indian War, Battle with French; English General, French and Indian War; Surrendered at Appomattox Court House; American Commander, Revolution (2); Surrendered to Cornwallis; Battle of Burgoyne.

Winthrop—Governor of New York (2); First English Governor of New York (3); Governor of Georgia; Governor of Virginia (2); First Puritan Governor of Plymouth; One of Pilgrim Fathers; Founder of Connecticut; Religious Leader in Colonies; General in Revolution; American General in Revolution.

¹² MEUMANN, E. *Intelligenzprüfungen an Kindern der Volksschule*. Die Experimentelle Pädagogik. 1905, 1: 35-101.

¹³ KIRKPATRICK, E. A. *An Experimental Study of Memory*. Psychol. Rev. 1894, 1: 602-609.

¹⁴ PETERSON, JOSEPH. *The Effect of Attitude on Immediate and Delayed Reproduction*. Jr. Ed. Psychol. 1916, 7: 530.

¹⁵ The figures in parenthesis indicate the number of times the respective answers were given, in case they appeared more than once.

John Marshall—Vice President of U. S. (7); Secretary of State (2); Manufacturer of Kippered Herring; Commander in Civil War; Against Slavery in Civil War; Anti-Slavery Leader.

Roger Williams—Founded Connecticut (3); Governor of Connecticut; Governor of Maryland; Governor, Massachusetts Colony; Had something to do with the Indians; Advocate of Slavery; Puritan Martyr; Burned at the Stake; A great Preacher driven out by Anne Hutchinson.

Cyrus W. Field—Inventor (2); Inventor of Reaper (4); Inventor Sewing Machine; Mower; Telegraph (2); Wireless Telegraph (3); Locomotive; Lawn Mower; Newspaper writer; Writer (2).

Samuel F. B. Morse—A statesman; Inventor; Wireless Telegraphy (6); Cable; Telephone; Atlantic Cable; Invented Type-writer.

William Lloyd Garrison—(Probably confused with William Henry Harrison) President of U. S. (9); Secretary of War; General; Editor of First Newspaper; Famous Southerner.

Daniel Webster—Wrote Dictionary (14); Noted Editor of Dictionary, and Statesman (6); Orator and Dictionary (2); Pro-Slavery and Dictionary; Debated with Lincoln; Statesman and signer of Declaration of Independence.

Ethan Allen—A negro; Spy (4); English Spy (2); Hanged as a Spy; Traitor (3); Poet; Stony Point; Leader, Battle of Bull Run; American General, War of 1812.

Green—General, Civil War (15); Confederate General; General, Revolution, Southern Side; Union General, Revolution; American General, Civil War; Southern General; British General in Revolution; Leader of Green Mountain Boys in Revolution.

Robert E. Lee—President of U. S.; Invented Engine; General in Revolution; British General in Revolution; English General, Revolution; Naval Commander, Revolution; General in Civil War; Surrendered to Americans.

James Oglethorpe—Founded Maryland; Founded a health colony; Delaware Colony; Dutch Governor, New York; Pioneer in Rhode Island; Leader of freedom laws, Rhode Island; Aided Negroes; English Explorer.

From these examples, such as any teacher of history might readily cull from regular papers in tests, it is obvious that certain tendencies obtain:

(a) With practically no exception the wrong answers are statements of some historical facts, but facts wrongly connected.

(b) General ideas as to being a statesman, general, settler, governor, inventor, tend to carry over with considerable accuracy but their application to specific factors is often most uncertain.

(c) Likewise general ideas are confused, as Union and American, Confederate and British.

(d) Names are interchanged as Wolfe and Montcalm, Cyrus W. Field and Morse.

(e) Some names are confused with names of similar sound, as William Lloyd Garrison and William Henry Harrison.

(f) Some names are confused with other names of the same surname, as "Stonewall" Jackson and Andrew Jackson; McCormick, the inventor with the Irish singer.

Wrong answers deserve more careful study; in many cases they may give the teacher more and better information about his teaching and the pupil than can be obtained from the traditional study of correct responses.

For grading school papers, there needs to be a standardized scheme for estimation wrong answers, especially confused answers. Suppose for example, in a given test, correct historical events are to be assigned to the dates, 1492, 1565, 1783, and 1807, and the actual answers given are: 1492, St. Augustine was founded; 1565, Columbus discovered America; 1783, Fulton invented the steamboat; and 1807, Lincoln was assassinated. Now what shall be the values of the answers? Doubtless almost any one would assign zero to the last; but to the third some would give some credit, and considerable credit would be given frequently to the first two answers. Evaluation of these types could be readily investigated scientifically. In the absence of experimental data the third, theoretically, is no better than no answer. The first two, which indicate a certain degree of mastery are, if strictly measured in terms of ultimate efficiency, worse than no answers. One thing is pretty certain, most imperfect answers are graded far too high. There is a human tendency for the teacher to read meaning into answers and to bestow credit generously for the pupil's effort and his good intentions. Doubtless the writer's errors in this study are to the point, and, consequently, the average percentages assigned the partially correct answers are too high.

This rather obvious tendency to rate too highly confused, vague and imperfect answers, puts a premium upon careless learning. It may be that the teacher while aiming to develop scientific habits in the child is actually developing some of the most unscientific habits. The problem is not simple, for, while efficiency demands accurate responses, the fear of wrong responses induces the learner to make no response, although the indispensable factor of all learning is the response.

SUMMARY

About 45 per cent. of the answers called for were correctly given; 23 per cent. were answered with partial correctness; 15 per cent. were wholly wrong; and 17 per cent. were not attempted. The total compiled efficiency was only 58.5 per cent. Presumably, then, about 40 per cent. had been lost.

Practically all the imperfect answers revealed confusion.

The order of familiarity for "military" names correlates rather highly (+.682) with Bagley and Rugg's frequency for mention by history texts, while there is practically no correlation for "civil" names.

There is a great need to measure delayed recall, in respect to the amount of things once learned which can be mustered into service several years after their first mastery. With tests devised so as to measure rather definitely the actual loss in retentiveness with time, one can hope eventually to measure relative values within a given subject, as well as the relative values of the several subjects, of the curriculum. To this end some preliminary studies on the same individuals to extend over several years are in progress.

A SCALE IN ANCIENT HISTORY¹

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The material used in this study of the range of information in ancient history and the scaling of difficulty of ancient history questions was taken from Myers' General History and the ancient period was defined as closing in the year 800 A. D. The basis for selecting the questions was to include only questions which every pupil who takes a course in ancient history must encounter. Topics which were treated with equal emphasis could not be selected as that depends upon the pupil's interest and the teacher's method, but every student being tested was expected to feel at every point a sense of familiarity in the presence of every question. Even where there could be no adequate recall they should feel that they had known it at some time but had forgotten. To do this the test material was submitted to a number of teachers of ancient history and many valuable suggestions were obtained. Nothing was included which did not meet with general approval from these teachers. It was tried in a preliminary way among University Freshmen and Sophomores coming from a wide range of schools and from classes just completing ancient history in the high school. These students were asked to point out any features which they had never encountered in a study of ancient history. After inspecting their answers to the questions and their comments upon them, the following test material was adopted:

Test No. I. For what are the following men noted? (1) Hannibal. (2) Khufu or Cheops. (3) Demosthenes. (4) Darius. (5) Solon. (6) Charlemagne. (7) Attila. (8) Constantine. (9) Mithradates. (10) Justinian.

Test No. II. Name a man noted in ancient history for each of the following: (1) Orator. (2) Painter. (3) Sculptor. (4) Historian. (5) Law-giver. (6) Philosopher. (7) General. (8) Ruler (King, Emperor, etc.). (9) Builder. (10) Poet.

¹ Special mention should be made of the painstaking assistance of several of my advanced students: Misses Luella Tankersley, Mary Williams, Kathleen Molesworth, and Mr. W. P. Webb. No statement here can give just credit to my colleague, Dr. Truman L. Kelley, for his assistance in the mathematical aspects of the problem. The test material was originally arranged by Miss Hazel Marsh.

Test No. III. Give the historical significance of each of the following: (1) Battle of Tours. (2) Age of Augustus. (3) Battle of Milvian Bridge. (4) The church council of Nicaea. (5) Check of the Saracens before Constantinople. (6) Reign of Alexander the Great. (7) Age of Pericles. (8) Founding of the Hebrew Monarchy. (9) Burning of Carthage. (10) Peloponnesian War.

Test No. IV. Between whom were the following battles fought: (1) Arbela. (2) Marathon. (3) Metaurus. (4) Teutoburg Forest. (5) Chalons. Name the victor in each case.

Test No. V. Give the approximate date of each of the following: (1) Fall of Rome. (2) Battle of Marathon. (3) Crowning of Charlemagne. (4) Establishment of the Saracen Kingdom in Spain. (5) Delian League. (6) The Hegira. (7) Defeat of Saracens by the Germans. (8) Battle of Actium. (9) Defeat of Persians by Alexander. (10) Establishment of the Roman Empire.

Test No. VI. What do you consider the most important contribution to civilization from these peoples? (1) Greeks. (2) Teutons. (3) Phoenicians. (4) Saracens and Arabians. (5) Romans. (6) Hebrews. (7) Persians. (8) Egyptians. (9) Babylonians. (10) Prehistoric Man.

Test No. VII. Mark each of the following peoples as being Hamitic, Semitic, or Aryan: (1) Greeks. (2) Egyptians. (3) Romans. (4) Hebrews. (5) Hindus. (6) Babylonians. (7) Teutons. (8) Assyrians. (9) Phoenicians. (10) Persians.

Test No. VIII. Name and mark the geographical locations on the accompanying map of ten points that you think were most important in ancient history. (Here was inserted an outline map of the Mediterranean World.)

The tests were arranged in a packet with blank spaces for answers and with the brief instructions at the top of each list of ten questions. Four minutes were allowed to each of the eight tests thus bringing the whole series with the preliminary information and the supplementary comments well within the 45-minute period. This time, short as it may seem, was decided upon after repeated trials during which the actual time consumed was observed. Even in regularly giving the tests there seemed to be little disposition to call for more time, or to give evidence of being hurried. Teachers who coöperated in giving the tests

and who anticipated that the time allowed would be inadequate were satisfied when they saw them given. Pupils were asked to write on an attached blank page their comments, criticisms, and complaints. Few complained of the time allowed and most reported that it had given them a fair opportunity to reveal what they knew, or rather that it had revealed to them how little they really remembered.

The nature of the questions combined with the manner in which they were presented test only one particular phase of historical information; viz., the ability to recall definite facts promptly. One of the chief marks of culture along historical lines, however, is to be able, when a lecturer mentions Greek philosophy, to think promptly of one or more exponents; when an ancient nation is mentioned, to be aware at once of some of the chief attributes and contributions of its people; when a battle which represents a turning point in civilization is mentioned, to know the contending forces and the results of the struggle. Thus the tests and the resulting scale measure only a limited and specific, though not an unimportant, kind of historical ability.

On the matter of grading pupils' answers, certain difficulties arose which are not present in arithmetic and spelling tests. The pupils' reactions could not be graded on the absolute standard of right or wrong. In nearly every attempt there were varying degrees of rightness or wrongness. The answer might be a real error or a wide variation from an otherwise correct reaction. To obviate this difficulty as much as possible all grading should have been done by the same person, so that the same standards of grading would be back of the evaluation of the questions. It was found to be impracticable to ask one person to make eighty judgments each on 933 pupils. Two directors of the grading were chosen and they worked over the correct and adequate answers which would be counted as 10 per cent, those that would be considered 5 per cent., and those for certain intermediate points. Sometimes this varied far enough from the method of right and wrong answers to be almost an arbitrary, but it was thought a more equitable, assignment of values. These two persons graded many of the papers and personally supervised and coached the assistants who also took part in the grading.

The following will serve as a sort of rough score card for grading. The ideas represented in the answers are given a weighting

which indicates the value placed upon that item in the answer when that idea is present.

TEST No. I.

1. Hannibal—A Carthaginian general (3) who crossed the Alps (3) and marched against the Romans (4).
2. Khufu or Cheops—An Egyptian ruler (2) who built the pyramids (8).
3. Demosthenes—Famous Athenian (3) orator (5) who roused his people against Philip (2).
4. Darius—Persian ruler (2) who led an army against Greece (8).
5. Solon—An Athenian (3) law-giver (7).
6. Charlemagne—King of France (4) A Holy Roman Emperor (3) and a great educator (3).
7. Attila—Leader of the Huns (4) who sacked Rome (6).
8. Constantine—First Christian (6) Emperor (2) the founder of Constantinople (2).
9. Mithridates—King of Pontus (6) who massacred the Roman inhabitants of Asia (4).
10. Justinian—Emperor of the East (3) who persecuted the Jews and Arians (2) and codified the Roman laws (5).

TEST No. II.

Any man mentioned as such in Myers' General or Ancient Histories.

TEST No. III.

1. Battle of Tours—Decisive victory for Christians (6) and the stopping of the Mohammedan invasion (4).
2. Age of Augustus—Golden age (2) of literature (5) for Rome (3).
3. Battle of Milvian Bridge—Where Christianity was accepted (7) by Constantine (3).
4. The church council of Nicaea—Determination of orthodox Christian doctrines (10).
5. Check of the Saracens before Constantinople—Saved civilization (3) and made Europe Christian instead of Mohammedan (7).
6. Reign of Alexander the Great—Extension of European powers over Orient (6) and the awakening of the civilized world (4).
7. Age of Pericles—Golden age of Athens (5) supremacy of Athenian learning (5).
8. Founding of the Hebrew monarchy—Establishment of Christianity (7) and the separation of the Hebrews from Athens (3).
9. Burning of Carthage—Rome becomes a world power (7) through the downfall of her greatest enemy (3).
10. Peloponnesian War—Gave Sparta supremacy of Greece (7) through the defeat of the Athenians (3).

TEST No. IV.

Graded by right and wrong cases; 5 points for each correct name in first and ten points each for correct answer in second part.

TEST No. V.

Within ten years, 10 points; ten to fifteen years, 9 points; fifteen to twenty years, 8 points, etc., within the same century, 4 points; outside the century, 0.

TEST No. VI. (Values not to be summated.)

1. Greeks—Culture (10), Art (5), Architecture (4), Literature (4), Philosophy and Science (4).
2. Teutons—Basis of civilization (10), Love of personal freedom (5), Respect for women (8).

3. Phoenicians—Alphabet (10), Commercial enterprise (10).
4. Saracens and Arabians—Science originating in Greece (10), Geometry and Algebra (10).
5. Romans—Law (10), Political interests (7), Military tactics (3).
6. Hebrews—Religion (10).
7. Persians—Satrapal form of government (10), Oriental customs (2).
8. Egyptians—Arts (8), Sciences (8) (both 10), Learning (3), Law (3).
9. Babylonians—Architecture (10), Literature and Religion (1), Science (3).
10. Prehistoric man—Fire (10), Language (10), Implements (5), Starting of civilization (2), Domestication of animals (8).

TEST No. VII.

Correct classification, 10 points. (Since chance alone would give $33\frac{1}{3}\%$, these questions have all been eliminated from the calculations.)

TEST No. VIII.

No score card devised and returns not yet employed in scaling.

Returns were secured from the complete surveys of the high schools of two large cities, two small ones, the random sampling of two other large ones and classes from two grades, Freshmen and Sophomores, in the University of Texas. A total of 933 papers were obtained filled out in acceptable form. These returns were graded by the score card and grouped on the basis of school, grade, and sex, though only the totals are employed in the calculations which follow. Grade and sex differences can be reported later.

The method of calculating and scoring was that used by most investigators along this line. The percentage of correctness in answering a question is assumed to be in inverse ratio to its difficulty, just as the percentage of those who spell a word is an inverse measure of its difficulty. This may not really be true in either case, but practically it is true, in that it measures the failure of present school methods to meet the situation, *i. e.*, it is a measure of inefficiency of the present methods of accomplishing the task. For present purposes the two are the same whatever might be the changed relation of difficulties and the new danger zones if teachers should begin to lay stress upon the points where deficiency is now apparent.

It was decided to use the Standard Deviation as the numerical measure for scoring the difficulty and arranging the questions on a linear scale. After calculating this standard deviation of 933 grades for some of the harder, some of the easier, and some near the median of the curve of difficulty and finding small difference, it was assumed that an average of those found would

closely approximate the average of all the sixty questions. This average was found to be 2.8. The probable error is negligible in this case.

TABLE I.

Showing Average Grades, Deviation from the Median, and the Derived Scale Values for Each of the Sixty Questions

Test no.	Av. gr.	M. V.	Sc. Val.	Test no.	Av. gr.	M. V.	Sc. Val.
I 1	3.9	— .32	187	IV 1	2.14	+ .31	250
2	3.01	— .004	219	2	4.28	— .46	173
3	4.9	— .68	151	3	1.66	+ .48	267
4	2.23	+ .27	246	4	2.85	+ .053	224
5	2.9	+ .04	223	5	1.59	+ .5	269
6	3.07	— .025	217	6	2.05	+ .34	253
7	2.91	+ .032	222	7	4.35	— .48	171
8	2.96	+ .014	221	8	1.66	+ .48	267
9	1.4	+ .57	276	9	1.92	+ .38	257
10	4.41	— .5	169	10	1.38	+ .58	277
II 1	7.23	— 1.5	69	V 1	3.4	— .14	205
2	.82	+ .78	297	2	1.76	+ .44	263
3	1.13	+ .67	286	3	2.36	+ .23	242
4	5.59	— .92	127	4	.67	+ .83	302
5	6.17	— 1.13	106	5	.73	+ .81	300
6	4.37	— .49	170	6	1.38	+ .58	277
7	7.83	— 1.72	47	7	.88	+ .75	294
8	7.62	— 1.68	54	8	1.24	+ .63	282
9	3.86	— .3	189	9	.7	+ .82	301
10	4.9	— .68	151	10	1.36	+ .58	277
III 1	2.38	+ .22	241	VI 1	5.73	— .97	122
2	3.46	— .16	203	2	2.24	+ .27	246
3	1.59	+ .5	269	3	4.65	— .59	160
4	1.95	+ .37	256	4	1.66	+ .48	267
5	2.43	+ .2	239	5	2.55	— .91	128
6	2.78	+ .078	227	6	2.59	+ .15	234
7	3.16	— .057	213	7	2.03	+ .34	253
8	.59	+ .86	305	8	2.83	+ .061	225
9	2.82	+ .064	225	9	1.50	+ .54	273
10	1.38	+ .58	277	10	2.77	+ .08	227

By observation of the average grades as found in the first column of Table I it was also found that the median grade of difficulty would fall not far from an average grade of 3 points. This was taken as the true median. The method of scoring was as follows: Question I has an average grade of 3.9 or .9 above the median in grade, or for the sake of clearer English, below the median in difficulty. Dividing this differential by the average standard deviation we have —.32, an index of the distance below the median of difficulty at which question I is to be located. Similar calculations were made on each of the other fifty-nine questions and the results are shown in the second column (M

V) of Table I. These values show the distance of each of the questions above or below the median and what is of greater importance the distance of each from the others. This, however, is still indefinite until some established point of reference is found. An inspection of the rough average grades of 933 subjects on each of the sixty questions shows that to no one was there a universally correct response; *i. e.*, no question had zero difficulty. The nearest approach was Nos. II₇, II₈, and II₁ with averages 7.83, 7.62, and 7.23, respectively. These were then submitted as Nos. B, D, and H in the following list of ten easy questions:

- A. Who were the people who lived in Egypt?
- B. Name a man famed in ancient times as a general.
- C. Was Julius Caesar a great man?
- D. Name a man in ancient history famed as an orator.
- E. Name a man mentioned in ancient history.
- F. Name a city mentioned in ancient history.
- G. On what river is Rome situated?
- H. Name a man in ancient history famed as a ruler.
- I. Was Alexander great?
- J. What is the name given to the large structures near the Nile River in Egypt?

TABLE II.

Ranks of Difficulty Assigned to Questions A to J by Ten Judges

	1	2	3	4	5	6	7	8	9	10	Av.
A.....	2	8	5	8	6	9	9	8	3	4	6.2
B.....	7	4	7	7	2	7	7	5	5	6	5.7
C.....	1	6	2	2	4	5	1	3	1	3	2.8
D.....	10	9	9	5	10	6	6	6	7	7	7.5
E.....	5	1	1	1	1	2	3	1	4	1	2.0
F.....	4	2	3	6	3	3	4	2	8	5	4.0
G.....	9	10	8	9	8	8	10	10	9	10	9.1
H.....	8	3	6	4	7	4	8	7	6	8	6.1
I.....	3	5	4	3	5	1	2	4	2	2	3.1
J.....	6	7	10	10	9	10	5	9	10	9	8.5

These questions were submitted to ten competent judges who ranked them as to easiness, leading to ten judgments for each question. These rankings are shown in Table II. Standing out prominent in these judgments is the indication that question E is the easiest of the group. This list was also submitted to a class of 27 high school pupils who attempted to answer the question. It was found that question E was answered by all the pupils; *i. e.*, it has zero difficulty for them. While this does

not establish the fact, it is safe to assume that the difficulty of question E does not lie far from zero for any one who has really made a study of ancient history.

It will be remembered that questions B, D, and H in this supplementary list are identical with Nos. 7, 1, and 8 respectively in Test II of the original series. This was arranged so that a zero, if found at all, would be determined in such a way that its relation to the original questions might be established. By calculating the relation existing between the three known questions and the unknowns in the easy series one is able to place the zero question in relation to the original sixty, and thus to give an established zero of reference for all of them. The method for marking this calculation was as follows:

From Table II it is seen that,—

Three of the 10 judges rank D easier than B. (Both known.)

Two of the judges rank B easier than I. (One known.)

Four of the ten judges rank I easier than E. (Both unknown.)

Then by using the standard deviation of the judgments on these questions as a measure of their difficulty, and interpolating those values already known the following equations are obtained wherein sigma (σ) signifies standard deviation in judgment of rank.

$$\begin{array}{l} \text{From D to B} = .84\sigma - .22 \text{ units from median} \\ \text{From B to I} = .52\sigma - X \quad \text{"} \quad \text{"} \quad \text{"} \\ \text{From I to E} = 1.28\sigma - Y \quad \text{"} \quad \text{"} \quad \text{"} \end{array}$$

$$\sigma = \frac{.22}{.84}$$

$$.52\sigma = .52 \times \frac{.22}{.84} = .136 = X$$

$$1.28\sigma = 1.28 \times \frac{.22}{.84} = .335 = Y$$

Now since question "B" is known to be at -1.72 from the median (See Table I) it follows that question "I" is at the algebraic sum of -1.72 and $-.136 = -1.856$. Likewise, question E is $-.335$ still farther down or at -2.191 . This then establishes a zero of difficulty at a point 2.191 units below the median difficulty. Having this point of reference and correcting all values in Table I (M. V.) to read from zero instead of above and below the median, the values in the second column of Table I (Sc. Val.) are obtained and are expressed with decimal point moved two places to the right to avoid fractions.

TABLE III.

Showing Scale Values, the Intervals Between Established Points on the Scale and Subtotals to Facilitate Finding Desired Points

No.	Sc. Val.	Sc. Int.	Totals	No.	Sc. Val.	Sc. Int.	Totals	No.	Sc. Val.	Sc. Int.	Totals
E	0	0	0	I 2	219	2	3231	V 2	263	6	8005
II 7	47	47	47	I 8	221	2	3452	IV 8	267	4	8272
II 8	54	7	101	I 7	222	1	3674	VI 4	267	0	8539
II 1	69	15	170	I 5	223	1	3897	IV 3	267	0	8806
II 5	106	37	276	IV 4	224	1	4121	IV 5	269	2	9075
VI 1	122	16	398	III 9	225	1	4346	III 3	269	0	9344
II 4	127	5	525	VI 8	225	0	4571	VI 9	273	4	9617
VI 5	128	1	653	III 6	227	2	4798	I 9	276	3	9893
II 10	151	23	804	VI 10	227	0	5025	III 10	277	1	10170
I 3	151	0	955	VI 6	234	7	5259	V 6	277	0	10447
VI 3	160	9	1115	III 5	239	5	5498	V 10	277	0	10724
I 10	169	9	1284	III 1	241	2	5739	IV 10	277	0	11001
II 6	170	1	1454	V 3	242	1	5981	V 8	282	5	11283
IV 7	171	1	1625	VI 2	246	4	6227	II 3	286	4	11569
IV 2	173	2	1798	I 4	246	0	6473	V 7	294	8	11863
I 1	187	14	1985	IV 1	250	4	6723	II 2	297	3	12160
II 9	189	2	2174	VI 7	253	3	6976	V 5	300	3	12360
III 2	203	14	2377	IV 6	253	0	7229	V 9	301	1	12761
V 1	205	2	2582	III 4	256	3	7485	V 4	302	1	13063
III 7	213	8	2795	IV 9	257	1	7742	III 8	305	3	13368
I 6	217	4	3012								

Table III presents these values in the order in which they would appear on the linear scale. Subtotals are also shown to facilitate grading when the scale is used.

The method of using the scale is very simple in plan but somewhat burdensome in detail. Pupils are to be given the tests of the original in whole or in part and their work graded on the basis of 10 per cent. for each question. The score card will serve as a rough guide. The average, or median, for the class is then found for each question. This grade expressed as a fraction of a perfect grade is then multiplied into the scale value for the question. The sum of these products is the class grade in total scale points. For instance, if the scale grade of the class is 3.6 on question 10 of Test II its scale value is $.36 \times 151 = 54$. Similar calculations on each question give the total scale points achieved by the class. Now if the sum of these points is found to be 3200 by reference to the column of subtotals it is found that the class has advanced to a point on the scale between 217 and 219. The exact point may be found at 218.7 if absolute accuracy is desired. This scale point of any individual or class

means that the individual or class can answer perfectly the equivalent of all the questions below this point on the scale. If they really fall short of answering these easy questions perfectly they will answer more or less perfectly enough of the harder questions to compensate for the errors in the easier ones. Thus, the scale becomes a quantitative rather than a rigidly qualitative measure of ability in these particular aspects of ancient history. It can be made more qualitative by scaling each test separately. In its present form, however, it is comparable with many other scales which measure the amount of retention in a certain school subject after a certain amount of training in that field. It still remains to determine the qualitative and quantitative lapsing of historical information as one is further and further from a definite study in the field.

TESTS OF THE MEMORIES OF SCHOOL CHILDREN

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The present study of memory was concerned with the questions: 1. Does a child's memory improve with age? With grade in school? 2. Is any sex difference in achievement in memory present? 3. Do the sexes differ in variability?

Six hundred and thirty-eight children, of whom two hundred and eighty-five were boys and three hundred and fifty-three were girls, were each given six tests. The children were in twenty-two classes in the grades 4A through 8B in a large city public school. The following table (I) shows the number of subjects at each age in each grade.

TABLE I.

Age of Children in Each Grade											Total
4A	4B	5A	5B	6A	6B	7A	7B	8A	8B		
8.5....	14	1									15
9.5....	47	21	14								82
10.5....	20	32	32	23	8	4		1			120
11.5....	6	10	25	33	26	24	2	4			130
12.5....	2	3	12	11	15	18	11	14	11	3	100
13.5....	2	1	1	3	9	9	13	19	19	15	91
14.5....			1		2	4	4	12	18	21	62
15.5....			1	1	2		5	3	5	10	27
16.5....							1		2	6	9
17.5....										2	2
	91	68	86	71	62	59	36	53	55	57	638

Each subject was tested for the recall of words, recall of geometrical forms, recall of nonsense syllables, recognition of words, recognition of forms, recognition of nonsense syllables. One exception was that the children in 8A were not tested for the recall or for the recognition of nonsense syllables. There were boys and girls in all the twenty-two classes so that, although the directions were given twenty-two times, the conditions were the same for the boys and the girls. Each subject had his or her material so that any advantage or disadvantage due to his or her position in the room might be avoided.

The subjects knew there were to be twenty-five items of each material presented and that they were to be given fifty seconds in which to learn as many as they could. To give some idea how long the period of fifty seconds is, a large picture was shown for that length of time before the experiments were begun. This

also served to attract the attention and interest of the children. After they had seen the twenty-five items for fifty seconds, ten seconds elapsed and then they were asked either to write down the items seen (recall) or to mark each of the fifty which were then presented YES or NO according to whether or not they had previously seen them (recognition). For recall the score for each was the number of items correctly written, or in the case of forms, drawn. For recognition, the formula suggested in Woodworth's laboratory outline was used, *i. e.*, score equals total number of items (in this case 50) minus twice the number of errors minus omissions, if there are any. Thus a perfect score for recall would be 25, for recognition 50.

Table II shows the average for the recall of words, forms, syllables and for the recognition of words, forms, and syllables for each grade. Table III shows the average for the recall of words, forms, and syllables for each age in the grades 4A through 8B. Children who have passed their eighth birthday but have not reached their ninth are called "8-year-olds" in this report; thus the average for "8-year-olds" is for age 8.5, for "9-year-olds," 9.5, etc. It should be noted that Table III does not indicate the average score for children eight years, nine years, etc., but for "eight-year-olds," "nine-year-olds," etc., as explained in the grades 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B of the school where the tests were made. There is a marked selection in the case of eight-year-olds, sixteen-year-olds and seventeen-year-olds. Only fifteen out of the 159 in the fourth year (4A and 4B) were eight years old, most of the children of that grade being at least nine years old. Due to the laws permitting children of 14 who have reached a certain grade to obtain their "working papers,"

TABLE II.

	Rc. Words		Rc. Forms		Rc. Syl.		Rg. Words		Rg. Forms		Rg. Syl.	
	Av.	P.E.	Av.	P.E.	Av.	P.E.	Av.	P.E.	Av.	P.E.	Av.	P.E.
4A....	4.22	.12	3.40	.12	1.79	.17	21.91	.78	7.98	.54	7.87	.53
4B....	4.94	.16	3.48	.13	1.69	.09	21.09	.99	7.72	.54	6.87	.66
5A....	5.43	.15	4.15	.12	1.79	.12	26.19	.90	10.09	.52	10.51	.58
5B....	5.63	.15	4.33	.15	2.20	.13	25.08	.80	9.10	.54	9.81	.71
6A....	5.92	.21	4.73	.16	2.16	.13	28.71	1.09	12.77	.65	15.82	.69
6B....	6.44	.15	5.24	.17	2.08	.11	31.10	.86	13.22	.66	12.86	.63
7A....	7.03	.27	4.97	.24	2.36	.17	28.83	1.16	8.28	.80	11.64	.97
7B....	7.75	.23	5.96	.17	2.74	.15	28.59	1.05	10.19	.64	12.51	.89
8A....	7.62	.22	5.40	.17			29.20	1.07	11.87	.76		
8B....	7.39	.20	5.37	.16	3.07	.17	30.82	.95	11.48	.71	14.74	.83

to the fact that most children of 16 and 17 have completed grade 8B, and to other causes, only 11 children of 16 and 17 were among the subjects in the 7th and 8th grades (7A, 7B, 8A, 8B).

Diagrams I, II, III, IV show graphically the results given in Tables II and III. For recall and for recognition according to grade there appears to be a slight general tendency toward improvement from the lowest grade to the highest, the lowest average score, however, is not always at 4A nor the highest at 8B. An inspection of the curves (Diagrams III and IV) for recall and recognition according to age within the grades shows a general tendency toward improvement from 9.5 to 15.5 years, regardless of grade within the range 4A through 8B. Since the curves for grade tend to show an improvement with grade and curves for age tend to show an improvement with age, it is possible that both grade and age have their influence. This leads to the questions: Do the youngest children in each grade have the best or worst scores? Do the oldest children in each grade do best or worst? Do those children whose age is the same as most of the other children in their grade have the best, medium, or worst scores?

The following method of scoring was adopted. One step in age was one year, 8 to 9, 9 to 10, etc., and for grade the step used was one year, 4 to 5 (4A, 4B), 5 to 6 (5A, 5B), 6 to 7 (6A, 6B), 7 to 8 (7A, 7B), 8 to high school (8A, 8B). If one adds the attendance in the A and B classes as given in Table I, and calculates the median one finds for Grade 4 it is at age 9.5, for Grade 5 at 11.5, for Grade 6 at 11.5, for Grade 7 at 13.5, for Grade 8 at 14.5. Turning to the scores for the recall of words, let us add the total scores of the nine-year-olds for Grade 4, of the eleven-year-olds for Grade 5, of the eleven-year-olds for Grade 6,

TABLE III.

No. of Subjects	Age	Rc. Words			Rg. Words		
		Rc. Forms	Rc. Syl.	Rg. Forms	Rg. Syl.		
		Av.	Av.	Av.	Av.	Av.	Av.
(15)	8.5	(4.60)	(3.27)	(1.00)	(18.13)	(5.40)	(9.87)
82	9.5	4.70	3.36	1.68	21.49	8.70	7.49
120	10.5	5.41	4.10	1.86	24.94	9.65	9.56
130	11.5	5.56	4.54	2.03	25.87	11.08	11.17
110	12.5	5.85	4.64	2.28	26.08	9.55	11.16
91	13.5	7.16	5.33	2.38	29.54	9.56	11.77
62	14.5	7.19	5.51	2.86	31.24	12.58	13.23
(27)	15.5	8.33	5.41	1.91	35.39	10.26	14.32
(9)	16.5	(6.11)	(5.11)	(1.43)	(24.55)	(9.11)	(6.67)
(2)	17.5	(10.00)	(6.00)	(5.00)	(39.00)	(11.00)	(15.00)

of the thirteen-year-olds for Grade 7, and for the fourteen-year-olds for Grade 8. We should then have the total score of those who were in a grade where the median age was their age. Dividing by the total number of persons whose scores have been added, we have the average score for the children who were in a grade where the median age was their age. Then let us find the scores of those who were one year, two years, etc., older and one year, two years, etc., younger than the median age for their grade. Thus our tabulation for the recall of words is:

TABLE IV.

SCORES								
—3	—2	—1	0	1	2	3	4	
		69	320	225	74	23	9	
	65	324	304	132	22	7	13	
		79	305	194	115	39	15	
11	40	181	252	115	60	8		
	114	257	285	127	47	20		
—	—	—	—	—	—	—	—	
11	219	910	1466	793	318	97	37	
SUBJECTS								
—3	—2	—1	0	1	2	3	4	
		15	68	52	16	5	3	
	14	55	58	23	4	1	2	
		12	50	33	18	6	2	
1	6	25	32	16	8	1		
	14	34	39	15	8	2		
—	—	—	—	—	—	—	—	
1	34	141	247	139	54	15	7	
Average.....	11.00	6.44	6.45	5.93	5.70	5.88	6.47	5.30

Calculations for all of the six tests show the following results:

TABLE V.

	—3	—2	—1	0	1	2	3	4
Rc. Words.....	11.00	6.44	6.45	5.93	5.70	6.47	6.47	5.30
Rc. Forms.....	6.00	5.36	4.87	4.51	4.45	4.60	4.60	3.57
Rc. Syl.....	0	2.65	2.49	2.26	2.19	2.87	2.87	2.43
Rg. Words.....	44.00	25.38	26.71	26.55	24.76	29.13	29.13	31.85
Rg. Forms.....	16.00	10.50	10.58	10.53	8.61	11.67	11.67	7.71
Rg. Syl.....	12.00	13.74	12.66	10.73	10.17	9.69	6.07	9.57

The score under zero is that of the children who were in a grade where the median age was their age, under —1 is that of the children who were one year younger than the median, under 1 is that of the children who were one year older than the median for their grade and so on.

It is evident that the oldest children in a grade on the average do not have the best scores, but they do not always have the

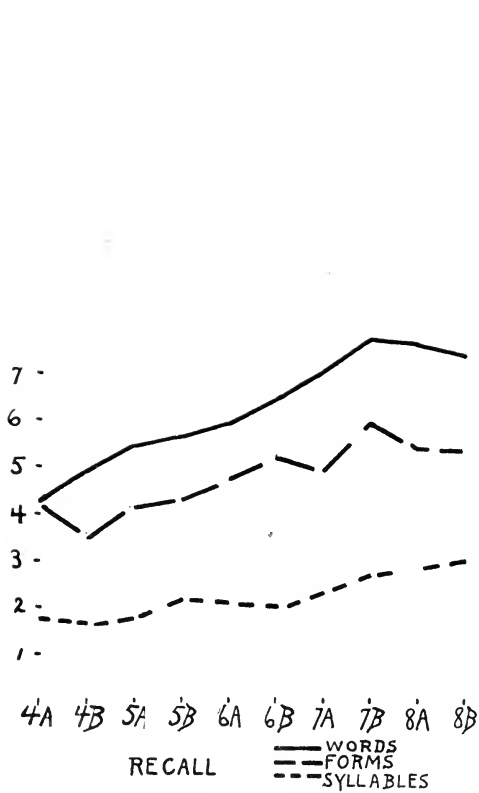


DIAGRAM I (See Table II)

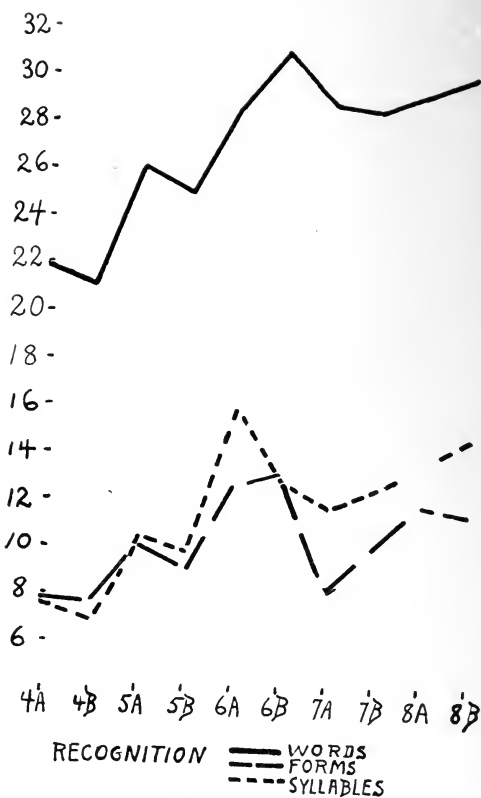


DIAGRAM II (See Table II)

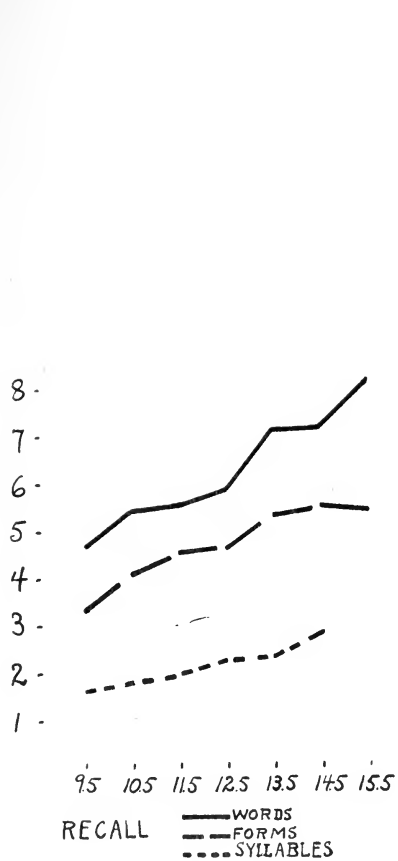


DIAGRAM III (See Table III)

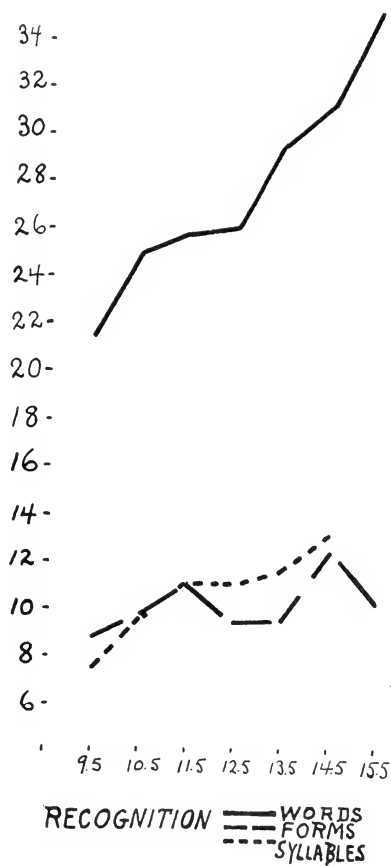


DIAGRAM IV (See Table III)

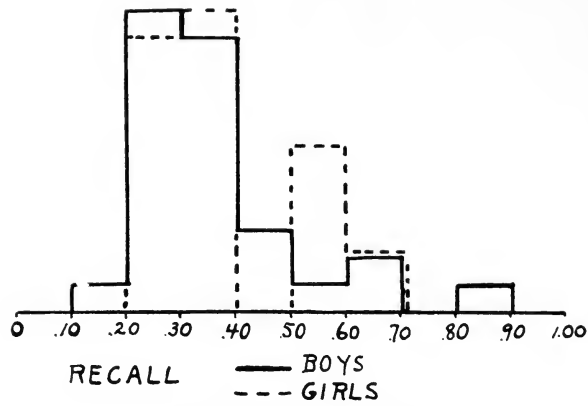


DIAGRAM V (See Table VI)

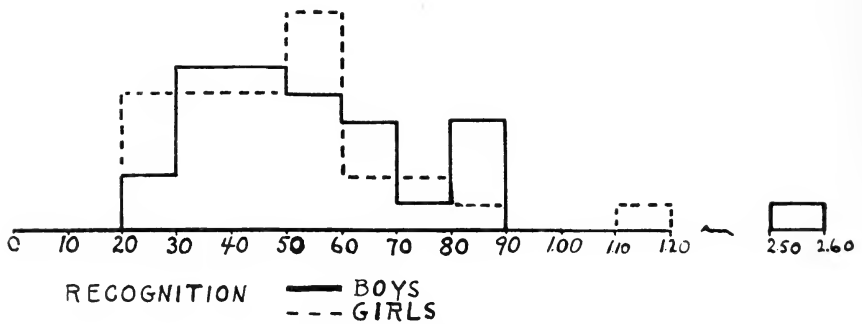


DIAGRAM VI (See Table VI)

TABLE VI.

Grade	Sex	Recall Words			Recognition Words		
		Av.	P.E.	P.C.	Av.	P.E.	P.C.
4A	B	4.12	.18	.3301	20.15	1.18	.4427
	G	4.30	.17	.3279	23.36	.97	.3485
4B	B	4.41	.20	.2925	14.79	1.35	.5842
	G	5.33	.23	.3246	23.32	1.34	.4250
5A	B	5.18	.21	.3050	23.74	1.24	.3863
	G	5.64	.22	.3103	28.19	1.15	.3303
5B	B	5.66	.19	.2544	23.88	1.18	.3744
	G	5.60	.24	.2750	26.73	1.18	.2858
6A	B	5.69	.30	.3198	29.38	1.27	.3261
	G	6.08	.26	.3076	28.22	1.39	.3250
6B	B	6.36	.23	.2013	24.45	1.45	.3292
	G	6.49	.19	.2182	35.04	1.05	.2226
7A	B	6.48	.34	.3114	27.12	1.43	.3119
	G	7.36	.42	.2269	32.73	1.87	.2215
7B	B	8.18	.34	.2298	24.04	1.11	.2558
	G	7.45	.32	.2847	31.81	1.34	.2785
8A	B	6.86	.29	.2274	29.62	1.29	.2366
	G	8.09	.28	.2410	28.94	1.43	.3417
8B	B	6.63	.35	.2338	27.68	1.19	.3555
	G	7.76	.30	.2332	32.39	.95	.2146

Grade	Sex	Recall Forms			Recognition Forms		
		Av.	P.E.	P.C.	Av.	P.E.	P.C.
4A	B	3.32	.17	.3916	7.56	.83	.8307
	G	4.30	.19	.3279	8.16	.71	.7328
4B	B	3.69	.23	.3225	8.10	1.03	.8136
	G	3.33	.15	.3273	5.36	.83	1.1567
5A	B	4.26	.20	.3451	11.15	.81	.5399
	G	4.15	.16	.3084	9.21	.67	.5094
5B	B	4.59	.21	.3508	9.73	.82	.6362
	G	4.00	.21	.3250	8.23	.83	.5747
6A	B	4.42	.24	.3303	11.88	.83	.4192
	G	4.95	.20	.2869	13.47	.95	.4996
6B	B	5.27	.22	.2941	10.36	1.13	.6071
	G	5.22	.22	.3027	14.92	.78	.3807
7A	B	5.08	.14	.1673	8.36	.58	.4103
	G	4.55	.46	.3956	8.09	1.09	.5266
7B	B	6.23	.21	.2071	9.77	.93	.5281
	G	5.77	.25	.2894	10.48	.83	.5248
8A	B	5.43	.24	.2431	12.14	1.01	.5461
	G	5.38	.23	.2918	11.71	.97	.5730
8B	B	5.63	.23	.2096	14.61	1.14	.4031
	G	5.24	.21	.2863	11.48	.87	.5523

Grade	Sex	Recall Syllables			Recognition Syllables		
		Av.	P.E.	P.C.	Av.	P.E.	P.C.
4A	B	1.54	.12	.6101	6.95	.81	.8777
	G	2.00	.15	.6200	8.62	.85	.8260
4B	B	1.51	.11	.4702	2.45	.97	2.5266
	G	1.82	.15	.5989	10.26	.89	.6404
5A	B	1.74	.19	.8218	7.34	.84	.8465
	G	1.83	.14	.6393	10.68	.78	.6403
5B	B	2.27	.18	.6123	9.98	.98	.7405
	G	2.10	.17	.5650	9.60	1.08	.7281
6A	B	1.81	.17	.4144	15.81	1.07	.4080
	G	2.41	.19	.5560	15.83	1.16	.4068
6B	B	1.86	.17	.5000	11.41	.88	.4294
	G	2.21	.16	.5112	13.19	.88	.4784
7A	B	2.24	.10	.2679	11.24	1.16	.6112
	G	2.64	.26	.3902	12.55	1.77	.5546
7B	B	3.00	.23	.3933	10.32	1.11	.5978
	G	2.55	.22	.5255	14.06	1.26	.5925
8B	B	2.84	.24	.4331	10.79	1.36	.6525
	G	5.37	.37	.5028	16.71	.98	.4261

worst scores. The children at the median age for their grade do not have the best nor the worst scores. There is a tendency for the scores of those who are younger than their classmates to be higher, except in the case of syllables, but the number of subjects is small for —3. The curves and these data suggest that there is a tendency toward improvement by age and by grade, but especially by age.

In Table VI are given the averages for each sex in each grade. If the averages are averaged, the following table (VII) is obtained:

TABLE VII.

	Boys	Girls	
Recall Words.....	5.96	6.41	G>B by .45
Recall Forms.....	4.76	4.69	G>B by .10
Recall Syllables.....	2.09	2.55	G<B by .46
Recog. Words.....	24.49	29.07	G>B by 4.58
Recog. Forms.....	10.37	10.11	G>B by .26
Recog. Syllables.....	9.59	12.61	G<B by 3.02

In four cases out of the six the girls were on the average better than the boys. Earlier investigators have said that girls were superior to boys in recall, but their interpretations of their data have not always seemed warranted. Chamberlain found no sex difference.

Table VI gives the variability of each sex in each grade for the six tests. The measure of variability here used is the gross variability divided by the average, known as the Pearson Coefficient of Variability.

In recall of words the variability for girls is greater than for boys six times out of ten; in recall of forms six out of ten; in recall of syllables seven out of nine; in recognition of words two times out of ten; in recognition of forms five times out of ten; recognition of syllables once out of nine times. Of the fifty-eight coefficients of variability 27 show greater variability for girls and 31 show greater variability for boys. As the diagrams (V, VI) indicate, no marked sex variability in memory tests is apparent.

SUMMARY

1. A child's memory seems to improve by age and by grade, possibly more by age.
2. For the memory of words and syllables the averages are slightly higher for the girls, for forms slightly higher for boys.
3. There appears to be no marked difference in sex variability.

ALLEGED ELEMENTS OF WASTE IN LEARNING A MOTOR PROBLEM BY THE "PART" METHOD¹

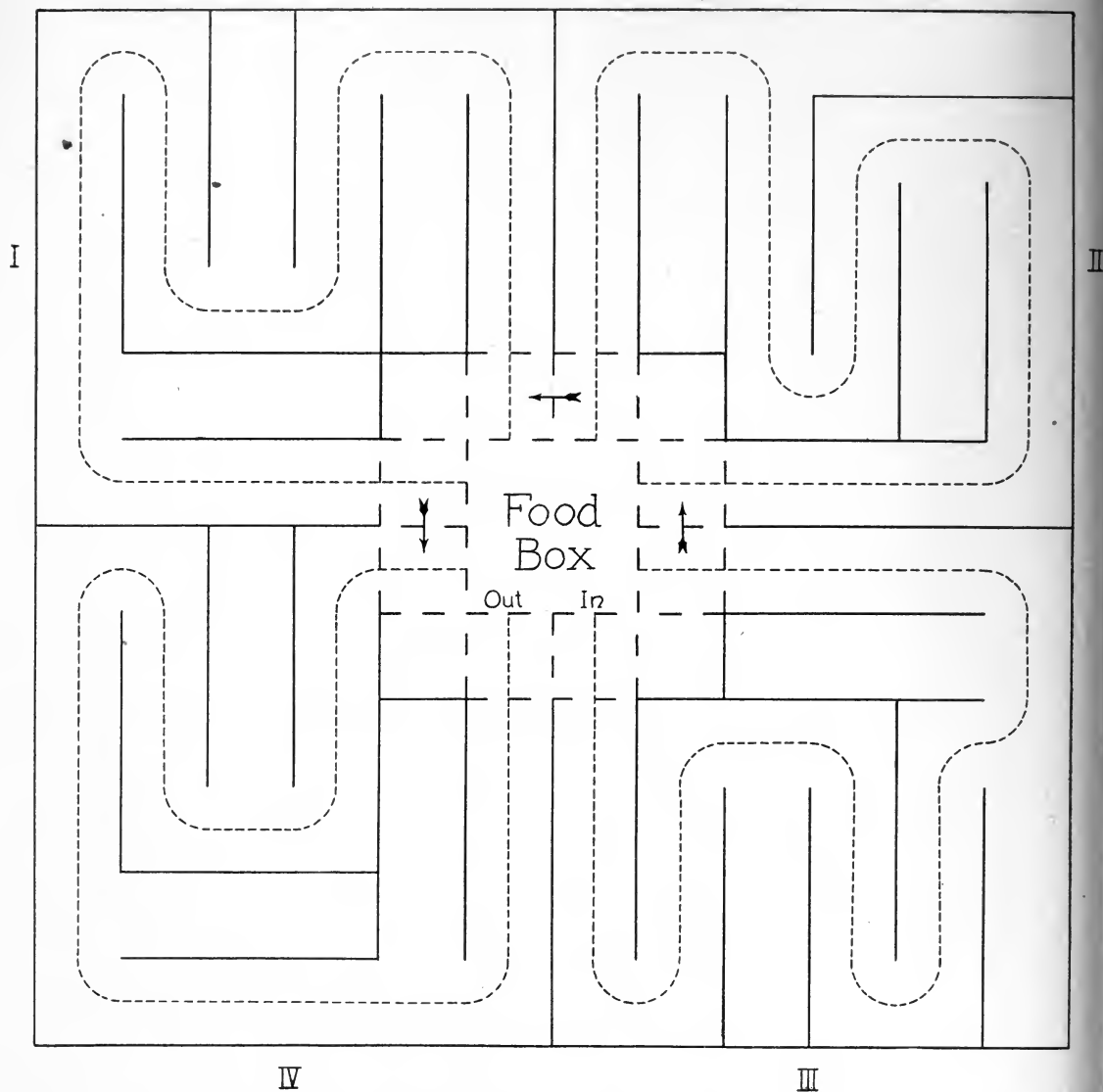
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Whole method procedure demands the continuous repetition of an entire body of material until the desired stage of mastery is attained. Part procedure demands an initial mastery of definite sections of the material and the final connection of these different sections in proper serial order. These two methods have been employed at length for investigating the learning of logical material (both prose and poetry) and also for nonsensical material. Although the various psychologists of the German, French and English laboratories have scarcely been uniform in their definition and use of the "part" method, nevertheless their results have been very uniform and accepted as conclusive. Consequently, it seems established that the "whole" method of learning is far more advantageous than the "part" method, both for speed of learning, more correct formations of associations, and more permanent retention. But the motor field of learning has not been given the same degree of attention showered upon rote and logical materials. This paper directs attention to the motor field.

Learning the maze is a type of motor problem that affords splendid opportunity for testing and comparing the whole and part methods. It is a problem whose general nature can be easily mastered, but which at the same time requires many trials and high energy expenditure for the setting-up of the many associations demanded. The cul de sacs, retracing opportunities, etc., offer many chances for error, all of which can be readily noticed and recorded by the experimenter. Also, there is no question as to when the problem is completely mastered by the various subjects, a nicety scarcely possible in the oral repetition of a long body of nonsensical material. Finally, the maze problem better than any other gives an opportunity for comparing the learning behavior of humans and lower animals when learning conditions are made identical.

¹ Read at the annual meeting of the American Psychological Association, Dec. 27-30, 1916.



A maze for testing learning by "whole" and "part" methods. Each of the four sections has an independent entrance and exit at the common center. The course of the true pathway is represented by a dotted running line. Dotted lines across the pathways represent removable panels. By means of these, it is possible to arrange the areas so that the maze can be learned as a whole; in parts later to be connected; forwards or backwards, etc. The rectangular areas around the center form a distributing gallery, by means of which the runner may pass from one section to some section not adjacent, *e. g.*, I-III.

The accompanying diagram represents a maze admirably suited for whole-part testing. There are four distinct parts or units to the maze, each possessing the same number and type of cul de sacs, the same linear distance in the true pathway, entrances and exits into a common open place, etc. By the removal of sliding panels, the maze can be learned as a whole or separately learned parts easily connected. Consequently, learning this maze is highly comparable to learning such material as a poem or a nonsensical series, where the sections are equated for length, and where the material may be learned as a whole, in parts or in any desired combination of parts.

The maze for the humans was constructed out of a cast brass plate, the true pathway and cul de sacs being represented by grooves. The maze was kept under screen and the subject, by placing his arm under the screen, learned the true pathway by traversing the grooved course with a pencil. Herein he was forced to rely solely upon the tactual-kinaesthetic avenues for data gathering. The maze was duplicated in every particular for animal learning, the animal maze being of the type common to the animal laboratories. Rats were used for this phase of the experiment. Though not deprived of vision (as was the case with the human subjects), the learning conditions for the rats are highly comparable to those of the human, as the rats have been shown to rely mainly upon the tactile-kinaesthetic sensory systems in mastering a maze area.

College students from the classes in Introductory Psychology were used as subjects. Each learner was assigned either the whole or some part method and given two trials in succession each day until the problem was mastered. The number of cul de sacs entered while going forward, those entered while returning toward the entrance, and the number of sections of the return path traversed were recorded as three different types of errors—A, B, and C. These, together with the time of each run and the number of trials required for complete mastery, constitute the data upon which the subsequent generalizations are based. Each rat was given two trials per day and the learning data secured as in the case of the humans.

Humans and rats agree in finding the whole method far more efficient, especially when no more retracing is allowed than is possible in part learning. For the humans, the whole method

shows an advantage of 26, 126, and 195% respectively, for the number of trials, time and errors. In the case of the rats, there is neither advantage nor disadvantage for the number of trials, but there is decided advantage of 13 and 44% respectively, for time and errors. Consequently, insofar as the maze type of learning can be taken as typical, it is conclusive that the pure part method of learning is non-efficient in the motor field, thus duplicating the results established for verbatim learning.

TABLE I.

Whole and Part Methods in Maze Learning

Method	No. of Individuals (Humans)	Trials	Time	A	B	Errors C	Total
Whole							
—Returns Allowed..	6	12	641"	16	13	97	126
Returns Prevented..	6	17	541	23	6	52	81
Part							
—Pure Part.....	6	23	1220	36	25	176	237
Progressive.....	6	10	352	10	3	44	57
Direct Repetitive....	6	11	618	15	11	70	96
Reversed Repetitive.	6	22	1014	27	24	175	226
Method	No. of Individuals (Rats)	Trials	Time	A	B	Errors C	Total
Whole							
—Returns Allowed..	12	27	4174"	54	24	139	217
Returns Prevented..	9	30	1666	56	4	51	111
Part							
—Pure Part.....	9	30	1907	74	17	108	199
Progressive.....	9	11	662	39	2	24	65
Direct Repetitive....	11	21	1442	45	9	88	142
Reversed Repetitive.	8	17	882	22	5	49	76

Tables to show the averages of human and rat groups in learning a maze by whole or part methods. The first whole method permits unlimited returning; the second allows no more retracing than is normally possible in the pure part method. The various part methods differ regarding the time and manner of the act of connection.

The elements of waste in part learning demand isolation. Several hypotheses are open for testing. In the first place, the high error and time scores in part learning may be due to the fact that learning the first motor units renders the mastery of the subsequent ones more difficult. This condition may be termed *negative transfer*. If control groups of learners are taught either units II, III, or IV and these scores formulated in ratio with the results of the part learners for the particular section, the strength of the negative transfer is easily measured. But such a comparison reveals that the part learners were not handicapped by having mastered earlier units but were materially aided. For

the humans there was a positive transfer of 2.3, 46, and 70% for sections II, III, and IV; for the rat situation, 43, 47, and 9% respectively.

A second hypothesis is that the waste is due to disintegration through time. Considering the fact that only two learning trials were given per day, quite a significant time interval elapses between the time the first units were learned and until they are again traversed in the final act of connection. For the humans, this time interval averages 13, 8, and 5 days for sections I, II, and III respectively, and 15, 11, and 4 days respectively, for the rats. When new learners are taught a single section and allowed to rest for the same interval that the part learners established, and the disintegration of the motor habit measured by the relearning expenditure, the disintegration is shown to be practically nothing. Most of the subjects retained a complete control over the activity and only showed a slightly slower speed for the first relearning trials.

A third hypothesis is that of retro-active inhibition. Perhaps learning the later units unseats the habits earlier set up. Specifically, does the part learner have a control over each unit when he again faces them in the complex act of final connection? New groups of subjects were taught all the motor units as for part learning, but were then not given the connecting trials. Instead, they were retrained upon unit I. This relearning expenditure is the measure of the retro-active effect exerted upon unit I because of having learned units II, III and IV subsequently. But the groups displayed almost perfect control over unit I. When retrained upon the remaining units, the identical retention of skill was shown. Consequently, it was clear that retro-active inhibition is to be disregarded as an explanation of why the part learners fail in the complex act of connection.

A fourth hypothesis is that of contiguity of unit functioning. The three earlier tests have shown that all the units can function perfectly as units, provided that a considerable time interval (24 hours) is allowed between tests. But in the final stage of part method learning, the units are forced into a contiguity of functioning. Does this cause the control over the units to be lost? Perhaps there is marked interference between the several acts if contiguity of functioning is required. To test this hypothesis, new groups were taught the four units and thereafter given

an opportunity not to connect the units but rather to have a single trial in various combinations of the units. For example, the task of the day might call for running the units *as units* in the order that completely reversed the learning conditions, namely,—IV, III, II, I. Since all the entrances and exits were from a common center, this was easily rendered possible. In no case did the groups average higher than $\frac{2}{5}$ ths errors per day. The subjects showed almost constant ability to adjust to changing requirements day after day, hence showing that the part learner has absolute control over all the units he has mastered, so long as these are kept as units.

A final hypothetical cause of waste is that of unit incompatibility in a larger series. Perhaps no unit can continue to function as a specific part of a bigger motor situation. Perhaps the many trials of connection suffice for uprooting the *unit* habits and establishing a single, comprehensive habit. But this is an extravagant assumption, as shown by the present test. The maze employed may be so adjusted as to compel the subject to run the problem as a whole, to run any part of it, or to eliminate certain unit areas and leave the beginning and terminal areas still in the act. Both humans and rats show an amazing accuracy in accommodating to such changes, whether these be in combinations I to III, II to IV, or apparently the most difficult one possible, namely IV to I. This warrants two conclusions,—that a motor unit can function as such, provided it is part of a larger whole; also, that no incompatibility between specific parts exists in the motor problem.

These five tests emphasize the necessity of excluding as factors of waste in part learning whatever refers to the mastery of the several units or the interrelationship between these units. To the writer, therefore, it seems apparent that all the waste in part learning occurs in the act of connection and is here traceable almost entirely to the influence of place association.

Place association refers to the definite location of an element of a problem in reference not only to the remaining details of that problem but to the entire environment. Waiving a demonstrable comparison between the case of rote learning and a motor problem of the maze type, (so far as each involves place association), attention may be directed to the types of positional relationships established in the motor problem now under dis-

cussion. These are temporal and spatial. A constant short time span for each unit means to the subject a cessation of the running and the substitution of some other desired activity. No doubt each critical turn of the course gets itself located in the entire time span just as definitely as a term is located in a series of nonsensical syllables. Again, a definite distance traversed comes to mean cessation of the running activity. Finally, each turn, cul de sac, and section of the true pathway becomes positionally established with reference to many aspects, *e. g.*, the opening into the food-box, the starting place, the position of the experimenter, etc. These positional establishments (the necessary by-products in the mastery of each unit) seem to demand breaking up when the units are being connected. Herein is assigned the waste in part learning.

Evidence for this may be drawn from three sources. In the first place, the behavior in the initial act of connection shows, by the constant returning to the starting place, the delay at closed exits, the hesitation, confusion, discouragement, etc., etc., that the runner is vainly relying upon short time and distance relationships to bring the changed activity previously secured. In the second place, the evidence produced by the tests earlier discussed argues for this hypothesis of place association. Here it was shown that all the units could function perfectly as units and that any part of a greater whole could function perfectly. In neither such case are the positional establishments destroyed. But a third line of evidence is experimental. Here this question must be answered: If the act of connection is controlled, cannot the learner be made to eliminate the positional factors while these are few and not deeply entrenched? To test the matter, several modified "part" methods were utilized. Space permits only a detailed discussion of the "progressive part" method.² Herein the subject learns the first two units as units and proceeds at once to the act of connection. Then Section III is mastered as a unit. This is immediately joined to the I-II unity previously established. Section IV, learned and connected, completes the entire series. The results are astounding. Both humans and rats master the

²For a detailed discussion of the several methods, see Pechstein, L. A. Whole vs. Part Methods in Motor Learning. A Comparative Study, *Psychol. Rev.*, Mon. Supp., Vol. XXIII, No. 2, 1917.

problem with scores far superior not only to those secured by the pure part method but especially to those made by the whole method. Also, this superiority is recorded by all types of measuring criteria, both time, trials and total errors. Moreover, the demonstrated superiority of this "progressive part" method is illustrated as well by several other modifications of the pure part method. All such methods set up positional relationships when the separate units are being mastered, but they demand a steady and progressive elimination of these. Upon the distributive handling furnished the positional factors, does much of their value rest.

Yet it seems reasonable that any progressive handling of the positional factors should be expected merely to cause the scores of the modified part methods to approach as a limit the much advertised attainments of whole method learning. But their demonstrated superiority certainly commands attention. There are certain inherent elements of strength to part method learning, to which time denies a discussion in this paper. These inherent advantages, taken in conjunction with the progressive and distributive handling of the positional factors, explain the superiority of the modified part methods over the whole method.

These remarks are meant to apply to that field of motor learning represented by the maze. However, the demonstrated advantages operating herein lead the writer to question a thorough-going statement of the superiority of the whole method in the fields of verbatim learning until the results of certain modified forms of part learning have been obtained and found inferior.

ABSTRACTS AND REVIEWS

RECENT PUBLICATIONS IN HISTORY

1. W. C. BAGLEY AND H. O. RUGG. *The Content of American History as Taught in the Seventh and Eighth Grades*. University of Illinois Bulletin, Volume 13, No. 51, August 21, 1916. Pp. 59.
2. W. C. BAGLEY. *Present Day Minimal Essentials in United States History as Taught in the Seventh and Eighth Grades*. The Sixteenth Yearbook of the National Society for the Study of Education. Part I. Second Report of the Committee on Minimal Essentials in Elementary School Subjects. 1917, pp. 143-155.
3. ERNEST HORN. *Possible Defects in the Present Content of American History as Taught in the Schools*. The Sixteenth Yearbook of the National Society for the Study of Education. Part I. 1917, pp. 156-172.
4. B. R. BUCKINGHAM. *Correlation Between Ability to Think and Ability to Remember, with Especial Reference to United States History*. School and Society. Volume V, April 14, 1917. Pp. 443-449.
5. SARAH A. DYNES. *Socializing the Child. A Guide to the Teaching of History in the Primary Grades*. Boston: Silver, Burdett and Company, 1916. Pp. x, 302.
6. HENRY JOHNSON. *The Teaching of History in Elementary and Secondary Schools*. New York: The Macmillan Company, 1915. Pp. xxix, 497. \$1.40.

With the present vigorous attack upon purely formal and disciplinary studies in both the high and the elementary school, the interest of educators is turning more and more to history as a content subject. The purpose of history is to bring the pupil to an acquaintanceship with the life of the past, in order that he may have a broader and better understanding of the various movements in the life of the present. How this aim is to be attained is receiving and should receive an increasing amount of attention. The two important questions involved are what shall be taught and how shall it be taught.

Undoubtedly the most important factor in determining what is taught in American schools is the text-book used, and the monograph of Bagley and Rugg (1) is an analysis of the subject matter contained

in typical history text-books published between 1865 and 1912. These texts, twenty-three in number, are divided into four classes, representing the years 1865-1874, 1881-1888, 1890-1904, and 1906-1912. There is little uniformity in the topical arrangement of the material in these texts, the number of periods varying from four to fifteen according to the individual whim of the author. The books of the more recent classes show a distinct improvement in the number and accuracy of bibliographical references, inserted either at the close of the sections or at the end of the book. Another characteristic of the more recent histories is the use of problem questions to stimulate the reflection of pupils. A noteworthy increase in the length of the more recent texts is also recorded.

Considering American history as made up of nine periods, a comparison of the different groups of texts is made from the point of view of the amount of space devoted to each period. The most striking change in treatment is found in the period 1783-1812 which increases from 6.4 per cent. in the earlier texts to 14.17 per cent. in the later ones. There is a significant decrease in the space devoted to colonial development, the Revolution, and the Civil War, while the periods of Discovery and Exploration, 1812-1861, and 1865 to the present show slight increases. It is clear that the tendency is to give greater attention to political, economic and social development and devote less space to military affairs.

The final chapter deals with what the authors call "The Hall of Fame," that is, the frequency with which public men are mentioned in school text-books. Of those most prominent in civil life, Lincoln heads the list and if we take his frequency as 100, Washington comes next with 84, Jefferson 82, Jackson 49, John Adams 46, and Madison 40. In military affairs Washington heads the list, and with him as the basis of comparison, R. E. Lee comes next with 83, Grant 76, W. T. Sherman 48, Cornwallis 42, McClellan 41. The study is an important contribution to the understanding of the contents of history text-books, and marks a distinct step forward in our study of the teaching of history.

In a second paper (2) Professor Bagley gives a detailed list of the topics treated in the twenty-three elementary texts studied. In this analysis the topics found in all of the elements are printed in small capitals, those found in three-fourths of the texts in ordinary type, and those found in a smaller number of texts but that have a considerable importance are enclosed in parenthesis. In addition to these topics

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the list includes the most important names found in elementary histories. Topics recommended by the Committee of Eight are indicated by asterisks. While the mere fact that a topic or name appears in a text is not sufficient reason for recommending the study of that topic to pupils, the consensus of opinion indicated here presents a very good starting point for the determination of minimum essentials in United States history.

The statement is frequently made that "the chief purpose of teaching history in the elementary school is to make pupils more intelligent with respect to the crucial activities, conditions and problems of present day life." Dr. Horn (3) made this the starting point of an investigation to determine what topics of historical nature were dealt with in representative books of political, social and economic affairs. The heads of the departments of political science, sociology and economics in the University of Iowa made out lists of problems of vital interest at the present time and made note of the books in which the best treatment of these problems was to be found. This resulted in a total of twenty-seven books and thirty-eight topics. These books were then subjected to a detailed examination for the dates most frequently mentioned, the periods of American history referred to, the phases of history involved, and the persons whose names occurred most frequently. It is interesting to note that of the twenty-six dates listed but a single one occurs in Professor Bagley's list compiled from the history texts. Such dates as 1492, 1607, 1765, 1812, 1861, were practically never found in the books and articles examined. The dates most frequently found were 1900 (one hundred fourteen times, in connection with twenty-two different problems), 1890 (eighty four times, with twenty problems), 1850 (fifty-six times, with fifteen problems), 1870 (fifty-three times, with twenty-one problems), 1830 (fifty-two times, with eight problems), and 1893 (fifty-two times, with sixteen problems). More than eighty-five per cent. of the references fell within the period 1861 to 1916, while in the case of the elementary text-books examined only twenty-four per cent. fell within that period. In the books on modern problems eighteen per cent. of the references dealt with political history, four per cent. with military, and seventy-eight per cent. with social and economic questions, while the texts showed forty-two per cent. political, forty per cent. military, and eighteen per cent. social and economic.

Of the persons mentioned Roosevelt heads the list with a score of two hundred eighty-four, Adam Smith comes next with two hundred

fourteen, J. S. Mill with one hundred seventy-four, Malthus with seventy-four, and Napoleon with sixty-four. Washington comes eleventh with twenty-nine, Jefferson fifteenth with twenty-four, Grant sixteenth with eighteen, and Alexander Hamilton twenty-eighth with a score of nine. It is obvious that there is no great agreement between the points emphasized in elementary history texts and those found in current discussions of social and political problems. Whether there should be any extensive agreement is a question which would afford material for discussion.

In a study of the answers made by pupils (4) to different types of history questions Dr. Buckingham sought to determine the relationship that existed between the ability to answer thought questions and information questions. The information questions proposed were of the usual type of examination questions in history, while as thought questions problems like the following were presented: "In 1790 ninety per cent. of the people of the United States lived on farms. At the present time only thirty per cent. of the people live in the country. How can you account for the change?" The regression coefficient for information on thought was .16; that of thought on information was .89. This means that for each unit of information ability a pupil shows .89 of thought ability, but for each unit of thought ability there will be only .16 of a unit in memory. In other words the score made on information questions is a much better index of thought power than the score made on thought questions is an index of information.

Instead of relegating the study of history to the upper elementary grades and the high school Miss Dynes (5) proposes to begin the development of the historic sense in the first grade. To be sure she does not expect any formal history work to be done there, but rather through play, construction work, pictures and stories she would familiarize the child with his immediate social environment, such as the functions of the policeman, fireman, street cleaner, health officer, mail carrier, milk man, grocer, carpenter, plumber, the relations of the child to others in the home, and the advantages it derives from such public enterprises as systems of water works, parks, playgrounds, streets, schools, hospitals and homes for the friendless.

In Grade II the life of primitive man is taken up, the transition from tree dwellers to cave dwellers indicated, the uses and control of fire studied, and the further development of man in occupations, travel and transportation is outlined. Existing tribes of primitive

men as the Eskimos and the American Indians are described. Grade III studies the home life, customs, and distinguishing features of four representative civilized countries, Holland, Germany, Japan and France. There is a chapter on the telling of stories introducing Bible characters, heroes of Greece and Rome, and an extended study of Columbus. The author gives valuable lists of reference books for the teacher's use, and the work is so well planned that any elementary teacher should succeed in arousing great interest and building a valuable foundation for later systematic historical study.

In Professor Johnson's book (6) we have the most recent, the most incisive, and the most illuminating study of the teaching of history that has yet appeared. The first five chapters are devoted to the history of the teaching of history. The simple narrative and the moralist-didactic types of historical account characteristic of early civilization and still favored by many school masters, are contrasted with the modern scientific conception of history, in which an objective interpretation of social conditions is striven for. Of all the aims that have been proposed in justification of the teaching and study of history the most convincing and the only really permanent aim is to understand the world in which we live,—to make the social world intelligible. History, therefore, is to be studied for its own sake, and not for any factitious material, political or moral advantage which the disciplinary conception of history is prone to amplify. Chapters four and five contain a valuable brief survey of the place of history in school curricula from the sixteenth century to the present time, with especial reference to France and Germany and to the recent developments in this country. The value of the biographical approach to history receives due appreciation, and the proper use of models, pictures, maps, text-books and collateral reading receives careful and discriminating treatment. The chapter on the correlation of history with other subjects in the curriculum, as geography, literature and government, presents a sympathetic account of the various plans that have been proposed for relating history to other subjects, but concludes with an expression of doubt whether such schemes may not be detrimental to history itself as well as disorganizing for the other subjects. The author believes that it will be well to leave to literature the imaginative re-creation of historic characters, to treat the governmental organizations of today as contemporary social rather than historical phenomena, and to confine the history work strictly to the task of interpreting the past. In a final chapter on the history

examination the author deplores the emphasis placed upon the memoriter reproduction of isolated historical facts, and urges a type of examination which will show the pupils' ability to interpret and utilize historical materials, situations or generalizations.

The task of the teacher of history is thus conceived as making the past real. In the accomplishment of this all imaginable aids and devices are to be employed, and ample opportunity must be given to the pupil for the manifestation of that "self-activity" which Froebel conceived to be the very essence of the learning process.

J. C. B.

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EDITORIALS

In discussing the aims of history study with teachers of that subject one frequently hears the statement, "I do not care to have my pupils

THE HISTORIC SENSE

learn dates and events, but I am particularly anxious to have them develop the historic sense."

What is this historic sense? How can it be developed? These are questions in which the educational psychologist is interested, and which it is incumbent upon him to attempt to answer. An eminent university professor of history who was lamenting the failure of high school teaching to develop the historic sense was asked what he meant by the term. After some discussion in which it became clear that he was thinking primarily of graduate students, embryo historians, he appealed to the wide differences manifested by members of the same class, and of approximately the same training, in the ability to orient themselves to new historical material. If two students are given a number of newspaper files and are asked to write the history of a town for a five-year period, one will give a clear, intelligible, well-articulated account, with the various events and movements in due

perspective, with adequate emphasis on a few leading features and proper subordination of details, while the other will have merely a hodge-podge of miscellaneous facts. The one shows the historic sense, the other does not.

The same difference is noticed, though perhaps not so clearly, in a class of college freshmen, especially if the course makes extensive use of source materials. Some pupils show great skill in the orderly arrangement of their historical data, skill in seizing upon essential points of the narrative and keeping these well in the foreground of their thinking, skill in massing minor considerations to support their main positions. Others take all statements with equal emphasis, keep all parts of the discussion upon the same level, and become hopelessly confused in the multiplicity of details.

The historic sense thus seems to be akin to what the newspaper man has in mind when he talks about "a nose for a story." It is a specialized form of that general selective ability which Thorndike in a recent article has shown to be of such vital significance in reading. Erroneous replies to questions upon a printed passage are due to the over-potency or under-potency of certain elements in the passage, thus leading to distortion of the thought as a whole. Adequate comprehension of the passage depends upon such a balanced potency of ideas that there is a mutual inhibition to dominance in response until all the elements have had an opportunity to exert their influence upon the final judgment. If the passage is familiar or the sequence of ideas habitual, the significant elements flash quickly to the foreground of consciousness. If the train of thought is novel or the passage is involved, we have to pause, re-read, dwell upon each element, perhaps drop out certain qualifying phrases altogether, before we are satisfied as to the meaning.

In like manner the historic sense, the appreciation of historic values, depends upon such a balance of potency in the single elements of the thought that the minor elements are subordinated and the major elements stand out as high points in the total complex. But what determines this profile pattern into which the historic thought landscape falls? Practice, training are undoubtedly of the highest importance, but native mental organization also plays a considerable part. A fascinating field for investigation is here offered to the experimentalist to determine native differences in historic ability, and to ascertain the effects of specific courses of training.

J. C. B.

Psychology, like other branches of science, is represented in the organization of the National Research Council by a committee whose purpose is to stimulate and coördinate investigation within its appropriate field that may develop methods or supply information of value to the military activities of the United States.

THE RELATION OF PSYCHOLOGY TO MILITARY PROBLEMS. This committee comprises Dr. Yerkes, Chairman; and Drs. Cattell, Dodge, Franz, Hall, Thorndike, Seashore, Watson, Whipple.

Other committies have been appointed by the Council of the American Psychological Association, as follows:

- On psychological literature relating to military affairs. Chairman; Dr. Bentley.
- On the psychological examining of recruits. Chairman; Dr. Yerkes.
- On the selection of men for tasks requiring special skill. Chairman; Dr. Thorndike.
- On psychological problems of aviation, including the examination of aviators. Chairman; Dr. Burtt.
- On psychological problems of incapacity, especially those of shock and re-education. Chairman; Dr. Franz.
- On the psychological aspects of vocational advice and training. Chairman; Dr. Watson.
- On recreation in the army and navy. Chairman; Dr. Coe.
- On pedagogical and psychological problems of military training and discipline. Chairman; Dr. Judd.
- On problems of motivation in connection with military service. Chairman; Dr. Scott.
- On problems of emotional stability, fear, self-control, etc. Chairman; Dr. Woodworth.
- On acoustic problems of military significance. Chairman; Dr. Seashore.
- On visual problems of military significance. Chairman; Dr. Dodge.

At the time of writing this note (June 5th), reports of progress have been made by nearly all these committees, and it is already evident that contributions of decided value may be expected in more than one direction.

The committee on the psychological examination of recruits, whose work would be in many respects of especial interest to the readers of this JOURNAL, may be cited in illustration. This committee comprises Drs. Bingham, Goddard, Haines, Terman, Wells, Whipple, Yerkes. At the courteous invitation of the Committee on Provision for the Feeble-minded, the committee in question has been in session since May 28th at the Training School, Vineland, N. J. The end of the first fortnight will see completed a provisional schedule (including direction-sheets, forms, record blanks, etc.) for the application of ten selected mental tests by the group method. It is planned to put these to immediate trial with various groups of adults, then to reassemble the committee about July 1st for further revision of the material, determination of methods of scoring, etc.

In addition to these ten group tests, which it is proposed to apply to every recruit in the concentration camps, the committee is also working out a program for individual tests that can be applied to all cases where more careful examination is indicated.

It should be explained that the work thus far represents directly or indirectly the voluntary activity of the American Psychological Association, and that the final acceptance or rejection of the program of mental examination of recruits is a matter for future decision by the military authorities at Washington. In any event, the desire of the psychologists is to work under the direction of the medical or other military authorities who control the disposition of recruits and to employ the methods of mental tests to secure information that may enable the proper authorities to proceed more precisely and intelligently in the selection of men for various kinds of military activity.

In this connection it may not be out of place to correct the impression that seems already to be current in some quarters that the idea of psychologists is to eliminate all imbeciles, morons, and individuals of low-grade intelligence generally from the army. On the contrary, there may be many situations in which these persons may perform useful service. What is necessary, however, is to know who these men are and what their limitations are.

There should also be reported here a resolution passed unanimously by the General Committee on Psychology of the National Research Council to the effect that psychologists, like other men of science, ought to consider seriously before enlisting in the regular line of the army, whether their familiarity with the methods of their science might not enable them to render more effective service to their country in some other direction. It is evident, for example, that the acceptance by the government of the plans just outlined for the mental examination of recruits will demand within a very few weeks the commissioning as scientific experts of one hundred or more specialists in psychology.

G. M. WHIPPLE

NOTES AND NEWS

The State of Iowa is to have the credit of establishing the first Child Welfare Research Station. The recent act of the legislature authorizing the appropriation of \$25,000 a year for this purpose inaugurates an attempt to do for human life what animal husbandry experiment stations have long done for the conservation of animal life. The work of the station includes six divisions, as follows: I. Heredity and prenatal care, focussing the resources of the rapidly growing science of genetics upon the problems of parenthood in Iowa; II. Nutrition of the child, investigating and combatting the causes of infant mortality in the state; III. Preventive medicine, including the study of infant diseases, preventive dentistry, hygiene of the nervous system, and the establishment of standards of normal development for Iowa conditions; IV. Social surveys, giving a basis for legislation on birth registration, sanitary codes, industrial regulation, and school attendance; V. Education and morals, with especial attention to the types of education that may be utilized by parents before the children are six years old; VI. Applied psychology, involving studies in mental health and growth. There is undoubtedly a splendid field for research in each one of these divisions, and the State of Iowa is to be congratulated on engaging in such a beneficent and far-reaching enterprise.

Under the direction of Dean C. E. Seashore, of the University of Iowa, surveys of musical talent have been made in the seventh and eighth grades of the public schools of Sioux City and Charles City, Iowa. As a result, seventy children have been encouraged to study music with the assurance that they possess native ability. Twenty-four of these had never had any special training in music. Since the development of latent resources is the highest form of wealth, and nothing can be compared with human resources, it is evident that such surveys promise to be a most valuable and productive feature of school activity.

The Bureau of Coöperative Research of the College of Education, University of Minnesota, has recently circulated a questionnaire to determine what modifications of educational practice have resulted from the application of educational measurements. The returns should make interesting reading. While it is undoubtedly true that educational measurements are of significance only in so far as they

furnish a basis for educational practice, a question may well be raised as to whether these measurements have been sufficiently developed and standardized to constitute an adequate foundation for educational procedure. The Courtis tests in arithmetic have been extensively used, but we know very little yet about what the results signify. Much more extended experimentation is necessary before educational measurements can furnish guides for teaching.

At a recent meeting of the Council of the American Psychological Association it was voted to authorize the organization of a committee of psychologists to coöperate with the National Research Council in connection with the war. Special investigations of problems connected with military affairs, such as the examination of recruits, re-education, shock, etc., will be undertaken, and the resources of psychological laboratories will be placed at the disposal of the Nation.

The Southern Society for Philosophy and Psychology held its twelfth annual meeting on April 12 and 13, 1917, at Randolph Macon Woman's College, Lynchburg, Va. It was voted to extend the scope of the Society so as to include "experimental education," and to hold the next annual meeting at Peabody College for Teachers, Nashville, Tenn. The following officers were elected: President, Prof. E. K. Strong, Jr., Peabody College, Nashville; Vice-President, Dr. T. V. Moore, Catholic University of America, Washington, D. C.; and Secretary-Treasurer, Prof. W. H. Chase, University of North Carolina.

Professor H. W. Conn, of Wesleyan University, known for his work on bacteriology, biology and evolution, has died at the age of fifty-eight years. His recent book entitled "Social Heredity and Social Evolution" is of particular significance for the theory of education.

Dr. Abraham Flexner, whose ideas in regard to "The Modern School" have recently created such commotion in conservative educational circles, has resigned from the New York City Board of Education, pleading pressure of other duties. Dr. Flexner has recently been advanced to the secretaryship of the General Education Board.

Dr. Walter F. Dearborn has been advanced from an assistant professorship to a full professorship of education at Harvard University. Dr. Henry W. Holmes has also been made full professor of education at that institution.

Dr. Frank W. Ballou, director of educational investigation and measurement in the Boston public schools, has been elected assistant superintendent of schools in that city.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

READING AS REASONING: A STUDY OF MISTAKES IN PARAGRAPH READING

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It seems to be a common opinion that reading (understanding the meaning of printed words) is a rather simple compounding of habits. Each word or phrase is supposed, if known to the reader, to call up its sound and meaning and the series of word or phrase meanings is supposed to be, or be easily transmuted into, the total thought. It is perhaps more exact to say that little attention has been paid to the dynamics whereby a series of words whose meanings are known singly produces knowledge of the meaning of a sentence or paragraph.

It will be the aim of this article to show that reading is a very elaborate procedure, involving a weighing of each of many elements in a sentence, their organization in the proper relations one to another, the selection of certain of their connotations and the rejection of others, and the coöperation of many forces to determine final response. In fact we shall find that the act of answering simple questions about a simple paragraph like the one shown below includes all the features characteristic of typical reasonings.

J

Read this and then write the answers to 1, 2, 3, 4, 5, 6, and 7. Read it again as often as you need to.

In Franklin, attendance upon school is required of every child between the ages of seven and fourteen on every day when school is in session unless the child is so ill as to be unable to go to school, or some person in his house is ill with a contagious disease, or the roads are impassable.

1. What is the general topic of the paragraph?

2. On what day would a ten-year-old girl not be expected to attend school?
.....
3. Between what years is attendance upon school compulsory in Franklin?
.....
4. How many causes are stated which make absence excusable?
.....
5. What kind of illness may permit a boy to stay away from school, even though he is not sick himself?
.....
6. What condition in a pupil would justify his non-attendance?
.....
7. At what age may a boy leave school to go to work in Franklin?
.....

Consider first the following responses which were found among those made to Questions 1, 2, 5 and 6 above by two hundred pupils in Grade 6. (All are quoted exactly save that capitals are used at the beginning here regardless of whether the pupils used them.)

	Percents.	Number per thousand
J 1. Unanswered.....	18	180
Franklin.....	4½	45
In Franklin.....	1	10
Franklin attendance.....	1	10
Franklin School.....	1½	15
Franklin attending school.....	1	10
Days of Franklin.....	½	5
School days of Franklin.....	½	5
Doings at Franklin.....	1	10
Pupils in Franklin.....	½	5
Franklin attends to his school.....	½	5
It is about a boy going to Franklin.....	½	5
It was a great inventor.....	½	5
Because its a great invention.....	½	5
The attendance of the children.....	½	5
The attendance in Franklin.....	½	5
School.....	7½	75
To tell about school.....	½	5
About school.....	4	40
What the school did when the boy was ill.....	½	5
What the child should take.....	½	5
If the child is ill.....	2	20
How old a child should be.....	½	5
If the child is sick or contagious disease.....	½	5
Illness.....	1	10
On diseases.....	½	5
Very ill.....	3	30
An excuse.....	2	20
The roads are impassable.....	1	10

Even rods are impossible.....	$\frac{1}{2}$	5
A few sentences.....	$\frac{1}{2}$	5
Made of complete sentences.....	$\frac{1}{2}$	5
A sentence that made sense.....	$\frac{1}{2}$	5
A group of sentences making sense.....	$\frac{1}{2}$	5
A group of sentences.....	3	30
Subject and predicate.....	$\frac{1}{2}$	5
Subject.....	$\frac{1}{2}$	5
The sentence.....	$\frac{1}{2}$	5
A letter.....	$\frac{1}{2}$	5
Capital.....	$5\frac{1}{2}$	55
A capital letter.....	$\frac{1}{2}$	5
To begin with a capital.....	2	20
The first word.....	$\frac{1}{2}$	5
A general topic.....	$\frac{1}{2}$	5
Good topic.....	$\frac{1}{2}$	5
Leave half an inch space.....	$2\frac{1}{2}$	25
The heading.....	$\frac{1}{2}$	5
Period.....	$\frac{1}{2}$	5
An inch and a half.....	$\frac{1}{2}$	5
An inch and a half capital letter.....	$\frac{1}{2}$	5
The topic is civics.....	$\frac{1}{2}$	5
The answer.....	$\frac{1}{2}$	5
J 2. Unanswered.....	6	60
Unless the child is so ill as to be unable to go to school.....	41	410
Unless the child is unable to go to school.....	$\frac{1}{2}$	5
Unless she is ill or the roads are impassable.....	1	10
Roads are impassable.....	1	10
When his baby or brother have some kind of disease.....	1	10
When a parent is ill.....	$\frac{1}{2}$	5
If her father or mother died.....	$\frac{1}{2}$	5
On her birthday.....	$6\frac{1}{2}$	65
On her fourteenth birthday.....	$\frac{1}{2}$	5
On every day.....	4	40
On any day.....	$\frac{1}{2}$	5
Expected every day.....	$1\frac{1}{2}$	15
On Monday and for 5 days a week.....	$\frac{1}{2}$	5
On Monday.....	1	10
On Friday.....	1	10
When school is in session.....	1	10
The beginning of the term.....	$\frac{1}{2}$	5
Fourteen year.....	$\frac{1}{2}$	5
Age 11.....	$\frac{1}{2}$	5
She is allowed to go to school when 6 years.....	$\frac{1}{2}$	5
A very bad throat.....	$\frac{1}{2}$	5
When better.....	$\frac{1}{2}$	5
J 5. Unanswered.....	2	20
If mother is ill.....	$5\frac{1}{2}$	55
Headache, ill.....	$\frac{1}{2}$	5
A sore neck.....	$\frac{1}{2}$	5
Headache, toothache or carache.....	$\frac{1}{2}$	5
When a baby is sick.....	$\frac{1}{2}$	5
Playing sickness.....	$\frac{1}{2}$	5
Serious.....	$\frac{1}{2}$	5
When the roads cannot be used.....	$\frac{1}{2}$	5
Contagious disease, roads impassable.....	$1\frac{1}{2}$	15
He cannot pass the hall.....	$\frac{1}{2}$	5
A note.....	$\frac{1}{2}$	5

J 6. Unanswered.....	15	150
Ill with a contagious disease.....	5	50
Seven years old.....	$\frac{1}{2}$	5
By bringing a note.....	6	60
When going with his mother to his cousin.....	$\frac{1}{2}$	5
Is to go his mother.....	$\frac{1}{2}$	5
When he is well and strong.....	$\frac{1}{2}$	5
To have a certificate from a doctor that the dis- ease is all over.....	$\frac{1}{2}$	5
Somebody else must have a bad disease.....	$\frac{1}{2}$	5
Torn shoes.....	$\frac{1}{2}$	5
Neat attendance.....	$\frac{1}{2}$	5
When he acts as if he is innocent.....	$\frac{1}{2}$	5
Being good.....	$\frac{1}{2}$	5
By being early.....	$\frac{1}{2}$	5
Get up early.....	$\frac{1}{2}$	5
Come to school.....	$1\frac{1}{2}$	15
Be at school every day.....	$\frac{1}{2}$	5
If he lost his lessons.....	$\frac{1}{2}$	5
Illness lateness or truancy.....	$\frac{1}{2}$	5
A bad boy.....	$\frac{1}{2}$	5
By not going to school.....	$\frac{1}{2}$	5
None.....	$\frac{1}{2}$	5
Not sick no condition and mother not ill.....	$\frac{1}{2}$	5
Not very good.....	$\frac{1}{2}$	5
When you come you get your attendance marked	$\frac{1}{2}$	5
Of being absent.....	$\frac{1}{2}$	5
His attendance was fair.....	$\frac{1}{2}$	5
Truant.....	1	10
If some one at his house has a contagious disease	$6\frac{1}{2}$	65
When roads.....	$\frac{1}{2}$	5
If he was excused.....	$\frac{1}{2}$	5
Not smart.....	$\frac{1}{2}$	5
If his father or mother died.....	$\frac{1}{2}$	5
By not staying home or playing hockey.....	$\frac{1}{2}$	5

In general in this and all similar tests of reading, the responses do not fall into a few clearly defined groups—correct, unanswered, error No. 1, error No. 2, and so on. On the contrary they show a variety that threatens to baffle any explanation. We can, however, progress toward an explanation, by using the following facts and principles:

In correct reading (1) each word produces a correct meaning, (2) each such element of meaning is given a correct weight in comparison with the others, and (3) the resulting ideas are examined and validated to make sure that they satisfy the mental set or adjustment or purpose for whose sake the reading was done. Reading may be wrong or inadequate (1) because of wrong connections with the words singly, (2) because of over-potency or under-potency of elements, or (3) because of failure to treat the ideas produced by the reading as provisional, and so to inspect and welcome or reject them as they appear.

Everybody, of course, understands that (1) plays a part but it is not so clearly understood that a word may produce all degrees of erroneous meaning for a given context, from a slight inadequacy to an extreme perversion.

Thus *Franklin* in the paragraph quoted (J) varies from its exact meaning as a local unit through degrees of vagueness to meaning a man's name (as in "Franklin attends to his school" as a response to question 1), or to meaning a particular personage (as in "It was a great inventor" as a response to question 1). Thus *Contagious* in paragraph J permits responses to question 5 (What kind of illness may permit a boy to stay away from school, even though he is not sick himself?) ranging from "Scarlet fever, chicken pox, measles or diphtheria," through "Scarlet fever," "headache," "Serious," "Hay fever," "Pimple," to "Contagious or roads impassable," and "All kinds of disease." Thus *Paragraph* in J 1 when over-potent produces responses ranging from "A group of sentences making sense" through "A group of sentences," and "A few sentences," to "The sentence," "Subject and predicate," "Begin with a capital," "A letter," and "Commas and periods."

In particular, the relational words, such as pronouns, conjunctions and prepositions, have meanings of many degrees of exactitude. They also vary in different individuals in the amount of force they exert. A pupil may know exactly what *though* means, but he may treat a sentence containing it much as he would treat the same sentence with *and* or *or* or *if* in place of the *though*.

The importance of the correct weighting of each element is less appreciated. It is very great, a very large percentage of the mistakes made being due to the over-potency of certain elements or the under-potency of others.

Consider first the over-potency of elements in the questions. The first question about paragraph J was, "What is the general topic of the paragraph?" A large group of answers show over-potency of *paragraph*. Such are those quoted above to show variation in the understanding of the word. We also find an over-potency of *top* (in topic) combined with that of *paragraph*, resulting in such responses as: "Leave a half-inch space," "An inch and a half," "An inch and a half capital letter," "The topic of paragraph is one inch in."

The second question was: "On what day would a ten-year-old girl not be expected to attend school?" We find under-potency of *not* resulting in answers like "When school is in session" or "Five days a week." We find under-potency of *day* resulting in responses like "She is allowed to go to school when 6 years," "Age 11," and "Fourteen years."

We find over-potency of *day* shown by "Monday," "Wednesday," and "Friday"; of *ten-year-old girl* in "The ten-year-old girl will be 5 a."

Ten-year-old is over-potent in an interesting way, namely, in the very large number of responses of "On her birthday." Over-potency of *Attend school* seems to be one part of the causation of "To attendance with Franklin," "Ever morning at half past 8," "She should," and "Because he did learn."

Consider next over- and under-potency of the words or phrases in the paragraph. The following list of responses shows that each of ten words taken from the paragraph is over-potent so as to appear clearly influential in the response to each of the first three questions (and in seven of the cases to the fourth question as well). These occur within five hundred responses made by children within grades 5 to 8. Cases of under-potency would be still easier to collect.

The questions, I may remind the reader, were as follows:

1. What is the general topic of the paragraph?
2. On what day would a ten-year-old girl not be expected to attend school?
3. Between what years is attendance upon school compulsory in Franklin?
4. How many causes are stated which make absence excusable?

(The numbers refer to the question to which the words were the response.)

Franklin	1. Franklin. 1. Franklin and the diseases. 1. Franklin topic.
	2. Franklin.
	3. Because it is a small city. 3. Franklin was in school 141 years.
attendance	1. Attendance.
	2. To attendance with Franklin.
	3. In Franklin attendance upon school is required. Attending school 130 days.
school	1. School. 1. They must know their lessons.
	2. In the beginning of school.
	3. School in session. 3. In the years of school.
seven	1. Seven and fourteen. 1. How old a child should be.
	2. He should attend school at 7 years. 2. Between seven and fourteen.
	3. Seven years.
	4. Under seven.
fourteen	1. Every child between seven and fourteen. In Franklin how old they are.
	2. Fourteenth of every day. 2. Fourteen years.
	3. Fourteen years. 3. Fourteen.
	4. 7 to 14.

- | | |
|------------|--|
| every | 1. Every child.
2. Expected every day. 2. On every day.
3. Every year. 3. Every child between fourteen or thirteen.
4. Every day. |
| ill | 1. Illness. 1. Very ill. 1. If the child is ill.
2. Ill. 2. A very bad throat.
3. He cannot go to school unless ill.
4. When child is ill. 4. Must be sick. |
| contagious | 1. Contagious disease.
2. If she is sick or has a contagious disease.
3. Contagious disease.
4. Contagious disease. |
| disease | 1. Fever. 1. About disease.
2. Often sick.
3. Unless ill or contagious disease. 3. Disease.
4. A terrible disease going out. 4. Because when a boy has disease. |
| impassable | 1. The roads are impassable. 1. Snow.
2. When roads are impassable.
3. Seven to fourteen years or the roads are impassable.
4. Or the roads are impassable. |

To make a long story short, inspection of the mistakes shows that the potency of any word or word group in a question may be far above or far below its proper amount in relation to the rest of the question. The same holds for any word or word group in the paragraph. Understanding a paragraph implies keeping these respective weights in proper proportion from the start or varying their proportions until they together evoke a response which satisfies the purpose of the reading.

Understanding a paragraph is like solving a problem in mathematics. It consists in selecting the right elements of the situation and putting them together in the right relations, and also with the right amount of weight or influence or force for each. The mind is assailed as it were by every word in the paragraph. It must select, repress, soften, emphasize, correlate and organize, all under the influence of the right mental set or purpose or demand.

Consider the complexity of the task in even a very simple case such as answering question 6 on paragraph D, in the case of children of grades 6, 7 and 8 who well understand the question itself.

John had two brothers who were both tall. Their names were Will and Fred. John's sister, who was short, was named Mary. John liked Fred better than either of the others. All of these children except Will had red hair. He had brown hair.

6. Who had red hair?

The mind has to suppress a strong tendency for *Will had red hair* to act irrespective of the *except* which precedes it. It has to suppress a tendency for *all these children . . . had red*

hair to act irrespective of the *except Will*. It has to suppress weaker tendencies for *John, Fred, Mary, John and Fred, Mary and Fred, Mary and Will, Mary Fred and Will*, and every other combination that could be a "*Who*," to act irrespective of the satisfying of the requirement "had red hair according to the paragraph." It has to suppress tendencies for *John and Will* or *brown and red* to exchange places in memory, for irrelevant ideas like *nobody* or *brothers* or *children* to arise. That it has to suppress them is shown by the failures to do so which occur. The *Will had red hair* in fact causes one-fifth of children in grades 6, 7 and 8 to answer wrongly,* and about two-fifths of children in grades 3, 4 and 5. Insufficient potency of *except Will** makes about one child in twenty in grades 6, 7 and 8 answer wrongly with "all the children," "all," or "Will Fred Mary and John."

Reading may be wrong or inadequate because of failure to treat the responses made as provisional and to inspect, welcome and reject them as they appear. Many of the very pupils who gave wrong responses to the questions would respond correctly if confronted with them in the following form:

Is this foolish or is it not?

The day when a girl should *not* go to school is the day when school is in session.

The day when a girl should not go to school is the beginning of the term.

The day etc. . . . is Monday.

The day is fourteen years.

The day is age eleven.

The day is a very bad throat.

Impassable roads are a kind of illness.

He cannot pass the ball is a kind of illness.

They do not, however, of their own accord test their responses by thinking out their subtler or more remote implications. Even very gross violations against common sense are occasionally passed, such as letting Mary give Tom a blue dog, or giving "Thought the man fat out" as an answer to I 1. Usually, however, the irrelevance or inconsistency concerns something in the question or the paragraph and the failure to heed it is closely akin to the under-potency of certain elements.

I.

Nearly fifteen thousand of the city's workers joined in the parade on September seventh, and passed before the hundred thousand cheering spectators. There were workers of both sexes in the parade, though the men far outnumbered the women.

1. What is said about the number of persons who marched in the parade?

* Some of these errors are due to essential ignorance of "except," though that should not be common in pupils of grade 6 or higher.

It thus appears that reading an explanatory or argumentative paragraph in his text-books on geography or history or civics, and (though to a less degree) reading a narrative or description, involves the same sort of organization and analytic action of ideas as occur in thinking of supposedly higher sorts. This view is supported by the high correlations between such reading and verbal completion tests, Binet-Simon tests, analogies tests and the like. These correlations, when corrected for attenuation, are probably, for children of the same age, as high as $+.80$.

It appears likely, therefore, that many children fail in certain features of these subjects not because they have understood and remembered the facts and principles but have been unable to organize and use them; or because they have understood them but have been unable to remember them; but because they never understood them.

It appears likely also that a pupil may read fluently and feel that the series of words are arousing appropriate thoughts without really understanding the paragraph. Many of the children who made notable mistakes would probably have said that they understood the paragraph and, upon reading the questions on it, would have said that they understood them. In such cases the reader finds satisfying solutions of those problems which he does raise and so feels mentally adequate; but he raises only a few of the problems which should be raised and makes only a few of the judgments which he should make. Thus one may read paragraph I with something like the following actual judgments:

Fifteen thousand did something—there was a parade—September seventh was the day—there were two hundred thousand something—there was cheering—workers were in the parade—both sexes in the parade—the men outnumbered the women.

Contrast these with the following which may be in the mind of the expert reader:

Nearly fifteen thousand—not quite, but nearly—of the city's workers—people who worked for a living—joined in the parade—a big parade of nearly 15,000—on September seventh—the parade was in the fall—they passed before two thousand hundred cheering spectators—two hundred thousand saw the parade—they cheered it—there were workers of both sexes—there were men workers and women workers in the parade—the men far outnumbered the women. Many more men than women were in the parade.

In educational theory, then, we should not consider the reading of a text-book or reference as a mechanical, passive, undiscriminating task, on a totally different level from the task of evaluating or using what is read. While the work of judging and applying doubtless demands a more elaborate and inventive organization and control of mental connections, the demands of mere reading are also for the active selection which is typical of thought. It is not a small or unworthy task to learn "what the book says."

In school practice it appears likely that exercises in silent reading to find the answers to given questions, or to give a summary of the matter read, or to list the questions which it answers, should in large measure replace oral reading. The vice of the poor reader is to say the words to himself without actively making judgments concerning what they reveal. Reading aloud or listening to one reading aloud may leave this vice unaltered or even encouraged. Perhaps it is in their outside reading of stories and in their study of geography, history, and the like, that many school children really learn to read.

PRELIMINARY INVESTIGATION OF SKIMMING IN READING¹

GUY M. WHIPPLE AND JOSEPHINE N. CURTIS

SUMMARY

This appears to be the first published experimental study of the process of skimming in reading. Six subjects, university students and instructors, read selected prose passages in different ways: silently at normal rate, silently at maximal rate, aloud at normal rate, aloud at maximal rate and by skimming (sometimes at their own rate, sometimes at a prescribed rate). The speed of reading was recorded by a stop-watch and in most experiments the efficiency of the reading was tested by demanding a reproduction, orally or in writing, of the passage read. Each subject also reported, especially after the skimming tests, how the skimming or reading was done and in what ways the skimming differed from the other modes of reading.

The chief conclusions are:

(1) There appear, even in this small group of college-trained persons, decided individual differences in speed and in efficiency of reading by all the methods, including skimming. One subject, for instance, skims three times as fast as another.

(2) The time per word, in hundredths of a second, is approximately this: normal aloud, 35; maximal aloud, 29; normal silent, 26; maximal silent, 22; skimming, 14.

(3) Knowledge that reproduction is to be demanded slows the rate of reading of all subjects by all methods.

(4) Speed of skimming increases in the later portions of texts several pages in length.

(5) The slowest reader is also the poorest reproducer.

(6) The best reproducer is a fast, though not the fastest, reproducer.

(7) The devices adopted in skimming are so different in different readers as to preclude summarizing.

(8) Skimming, itself, embraces at least five different varieties, or modes.

(9) When readers are forced to skim at a prescribed and unusually high rate, reproduction becomes very poor and the whole process becomes disagreeable and flurried.

¹ This investigation was carried on at the Educational Laboratory of Cornell University, from February to May, 1914. The general arrangement and supervision of the work was in the hands of Professor Whipple, now of the University of Illinois; the actual experimentation was in the hands of Dr. Curtis, now Assistant Psychologist at the Psychopathic Hospital, Boston. Acknowledgment is due to Mr. W. K. Layton, Assistant in Education, University of Illinois, for valued help in preparing the results for publication.

(10) Preferred rate in skimming is fairly closely correlated with natural rate in ordinary reading—the coefficient of correlation between normal silent and skimming speeds is $+0.71$.

(11) Subject matter lying outside the reader's general range of information would undoubtedly be skimmed only with difficulty and poorly, since in successful skimming much is supplied by the reader's previous information or his interpretation of the writer's intent as gathered from the context.

(12) It seems probable that practice in skimming might profitably be given in the public school.

INTRODUCTION

Although attention has been paid to the rate of reading and queries have been raised as to the possibility of developing more rapid rates in school children or of gaining speed by eliminating audition and getting meaning directly through vision, and although here and there there has been occasional mention of the shifts that occur in mental processes with very rapid reading, yet, so far as the writers know, this account is the first experimental study dealing primarily and directly with the subject of skimming.

The following citations are illustrative, though not exhaustive, of the literature to which we refer:

"Doubtless many of us dawdle along in our reading at a plodding pace which was set and hardened in days of listless poring over uninteresting tasks or in imitation of the slow reading aloud which was so usually going on either with ourselves or with others in the school." (Huey, *Psychology and Pedagogy of Reading*, pp. 179ff.)

"One of the great advantages of the shorter lines [as in newspapers] is that they constantly permit the reader to see in indirect vision what his eye has just passed as well as what is coming . . . a most desirable condition for all reading and especially for fast reading or for skimming." (Huey, *Op. cit.*, p. 411.)

"Any arrangement which makes comprehensive skimming an easy matter will be of great benefit for large parts of our reading." (Huey, *Op. cit.*, p. 423.)

In all these exercises [brief blackboard exposures of words to be acted out by children] the endeavor is to train the child to omit the auditory image, to develop speed in reading and to read for thought." (Klapper, *Teaching Children to Read*, p. 26.)

"The good reader takes all reading to be his province. Newspapers, periodicals, books, old and new, all present themselves to him in their proper perspective; they are all grist to his mill, but they do not go into the same hopper or require the same process. . . . Milton may be read in words or lines, Macaulay in sentences, Thackeray in paragraphs, and Conan Doyle in pages. . . . Skimming and rapid reading are different processes, but skimming is at times a good thing, too; even skipping becomes, on occasion, a sacred duty. . . . For skimming implies cream and skipping, a foothold somewhere." The clever reader finally learns to use his eye like a sixth sense, selecting the gist of the matter in whatever form it may appear. (Anonymous writer in the *Atlantic Monthly*, July, 1902.)

"The principles laid down in this most suggestive article [the foregoing one in the *Atlantic Monthly*] are, however they appeal to common sense, relatively unrecognized in the teaching of reading. Teachers, when they thought at all of the importance of reading with different paces, have, it seems, either feared to meddle with anything so dangerous and novel or else they have thought that experience would bring ability to each reader. Unfortunately, it does not always do so, and many a man has wasted days and days in conscientiously going through a process that could have been variously modified with great profit to himself. . . . Training in place of reading and in silent reading are open fields that invite every earnest teacher who would make a real contribution to his pupils as well as to education in general." (Briggs and Coffman, *Reading in Public Schools*, p. 14.)

"When one reads a selection for the sake of the information it contains, he may want all the facts, or only the most important facts, or the argument or the trend of the thought; he may want certain facts or he may want simply to determine whether certain facts are there or not. Each of these distinct purposes requires that the selection be read in a way adapted to the end sought. . . . No doubt many teachers, accustomed to insist on literal thoroughness, will see in such half-way reading and 'skimming' as is here advised the sure road to most careless and slovenly habits, which, even with all their 'thoroughness,' they are unable wholly to correct." (Spaulding, *Preventing and Correcting Defective Reading*.)

"A habit of slow reading may be fixed which retards the development of the normal speed. . . . *Some reading exercises should be given with a time limit*, but individual differences of ability should not be overlooked, and *hurried* reading should be avoided." (*The Teaching of Reading*, State of New Jersey, Department of Public Instruction, July, 1914, p. 14.)

Titchener says that his rate of reading varies considerably, both with the subject matter and with the purpose in reading. He would take a new book or article at a rush and then later go over it minutely and slowly if he wished the details. The headlong first reading is visual and diffusely organic in character; the reader pays little regard to headings or italics, taking in the first few words of a sentence and then jumping to catch-words, sometimes omitting entire sentences and even paragraphs. The organic reaction he believes to be widespread and strongly affective; he notes also a play of facial expression. The idea is emphasized that sight and "attitudinal feel" do the skimming, with occasional assistance from internal speech. (*Experimental Psychology of the Thought Processes*.)

These citations indicate that, while several writers have urged the desirability of increasing the rate of reading for certain situations and while a few writers have even given thought to devices of instruction or of typography that would facilitate skimming, yet those who have direct charge of developing the reading habits of children are inclined to look doubtfully upon the idea of direct training in skimming.

These citations suggest the desirability of studying the process of skimming more carefully. Of course, not every one that reads does, or can skim, but we may surmise that in persons who read a great deal there is a tendency to skim, at least with certain kinds of material, and we may further surmise that this manner of reading may be further developed by training; possibly, indeed, it might be desirable to give regular practice in skimming to children in the upper grades of the schools after they have sufficiently mastered the mechanics of ordinary careful word-by-word reading.

Such were the considerations that led to our study. It was not found possible to narrow the field of investigation to the extent we might have wished, since, as our citations show, there was no precedent for choice of method or material; consequently, we had to grope our way along and our results can claim to be no more than tentative outcomes of a pioneering survey.

THE OBSERVERS

The observers were *B*, Mr. Boring, an instructor in experimental psychology who was accustomed to skimming; *Fr*, Mr. Frazer, an assistant in educational psychology, who did not skim but read very fast, finding this more economical than to do the selecting necessary in skimming; *Gst*, Mr. Goldstone, an undergraduate who read very rapidly but did not skim and who had a slight speech defect (a lisp and a tendency to stutter); *Sk*, Mr. Skinner, a graduate working in psychology and educational psychology who read slowly and did not skim except when looking for some particular thing on a page; *D*, Miss Dimmick, an undergraduate who had done considerable work in psychology and educational psychology and who read very fast without skimming; and *Gou*, Miss Goudge, a graduate working in psychology and educational psychology, who said that the nature of the subject matter determined her method of reading.

METHOD OF EXPERIMENTS

Five kinds of reading were used: (1) reading silently at what the observer considered his normal rate; (2) reading silently at maximal rate; (3) reading aloud at normal rate; (4) reading aloud at maximal rate, and (5) skimming. The observer held the material in his own hands and started skimming or reading at a signal, saying "Finished," or "Done," when the assignment was completed. He was told beforehand how many pages there were in each article, that he would be required to reproduce, either orally or in writing, as much of the article as possible, and that after the reproduction he would be asked to give a detailed description of how he skimmed or read, especially as to differences between skimming and reading. By the use of a split-second stop-watch the time spent on each page and on the whole article was accurately recorded. The material used varied from one set of experiments to another, sometimes typewritten sheets, sometimes books on educational topics.

PRELIMINARY EXPERIMENTS

Preliminary experiments were performed both to ascertain what method and what material would probably be best for the main experiments and also to give the observers some practice. Typewritten sheets were used as the material; these were of equal length, and did not vary as to type, spacing, margins, paragraph-

ing, etc., but only in subject matter and style. Since the sheets contained almost exactly the same number of words, the rate of reading is recorded in the average number of seconds required to read the pages, and not—as in the later tables—in the average time spent on each word. The observers who took part in these preliminary experiments were *D*, *Fr*, *Gou*, *Gst*, and *Sk*.

TABLE I.

Observer	Average Time Taken for Reading Typewritten Sheets at the Various Rates							
	Silent				Aloud			
	Normal		Maximal		Normal		Maximal	
	Time	Rank	Time	Rank	Time	Rank	Time	Rank
D.....	72.5	2	68.3	4	81.9	1	77.2	3
Fr.....	78.5	3	50.3	2	86.0	3	64.0	1
Gou.....	89.6	4	74.0	5	84.6	2	75.0	2
Gst.....	51.9	1	47.6	1	91.4	4	84.4	4
Sk.....	93.5	5	67.3	3	92.1	5	85.6	5

TABLE 2

Observer	Percent of Typewritten Sheets Reproduced							
	Silent				Aloud			
	Normal		Maximal		Normal		Maximal	
	Percent.	Rank	Percent.	Rank	Percent.	Rank	Percent.	Rank
D...	36.73	3	29.70	2	27.52	5	24.17	3
Fr...	57.61	1	39.18	1	66.41	1	31.73	2
Gou.	42.28	2	21.85	3	29.81	3	23.26	4
Gst..	34.50	4	17.40	4	41.32	2	34.01	1
Sk...	18.00	5	15.35	5	27.98	4	17.86	5

From the tabulated results of the preliminary experiments (Tables 1 and 2), we find that *Gst* is a very rapid silent reader. He reports no kinaesthetic imagery at all and very little auditory imagery, so it is quite probable that he is a visual reader. *Fr* is evidently the best reproducer, and *Sk* the poorest. The others show considerable variation. In comparing Tables 1 and 2 we find that the slowest reader is the poorest reproducer, and that the best reproducer is above the average in speed of reading. Table 3 records the results secured when the material was read with the definite knowledge that it would not have to be reproduced. The significance of these figures, while not apparent here, will be evident later.

TABLE 3

Decrease in Time Required to Read a Sheet (on the Average) When Reproduction was Not Required

Observer	Silent		Aloud	
	Normal	Maximal	Normal	Maximal
D.....	10.7 (14.76%)	14.0 (20.50%)	2.2 (2.69%)	1.1 (1.43%)
Fr.....	19.1 (24.33%)	8.1 (16.10%)	7.6 (8.84%)	7.5 (11.72%)
Gou.....	31.0 (34.60%)	26.1 (35.27%)	5.3 (6.26%)	15.4 (20.50%)
Gst.....	00.4 (0.77%)	04.7 (9.87%)	11.0 (12.04%)	7.9 (9.36%)
Sk.....	30.7 (32.83%)	3.5 (5.20%)	2.0 (2.2 %)	5.1 (5.96%)

In the second part of the preliminary experiments the type-written sheets were abandoned because of the relative illegibility of the print, the evident advantage in skimming of having the material divided properly into paragraphs, and the difficulty of providing enough sheets for the entire experiment. Selections from the *Bulletins* of the United States Bureau of Education were used instead. In any one bulletin three selections were read: one normal silent, one maximal aloud, and the third skimmed in roughly one-half or one-third the time which the observer would probably have taken to read the selection at normal silent speed. Reproductions were taken as before. The results of this work will be found in Tables 4 and 5.

TABLE 4

Average Time per Word and Average Per Cent. of Material Reproduced from the Bulletins

(Figures are enclosed in parentheses when the number of cases is too small to ensure accurate results.)

Normal Silent		Maximal Aloud		Skimming (½ Normal)		Skimming (⅓ Normal)	
Time	Percent.	Time	Percent.	Time	Percent.	Time	Percent.
D....	.27	.25	63	.11	28	.08	35
Fr....	.22	.20	90	.11	45	.08	60
Gou...	.24	.22	50	(11)	10	.08	30
Gst...	.12	.24	(42)	.06	5	.04	30
Sk....	.33	.28	53	.15	25	.10	30

TABLE 5

Observers Arranged in Order of Speed of Reading and of Excellence of Reproduction from the Bulletins

Normal Silent		Maximal Aloud		Skimming (½ Normal)		Skimming (⅓ Normal)	
Time	Percent.	Time	Percent.	Time	Percent.	Time	Percent.
Gst	Fr	Fr	Fr	Gst	Fr	Gst	Fr
Fr	D	Gou	D	D	D	Fr	D
Gou	Gou	Gst	Sk	Fr	S	Gou	Gst
D	Sk	Gst	Gou	(Gou)	Gou	D	Gou
Sk	Gst	Sk	(Gst)	Sk	Gst	Sk	Sk

From these tables we may conclude that *Fr* is the best reproducer, *D* the next best, and that *Sk* is the lowest reader. Here the results for *Fr* and *Sk* agree with those obtained from the earlier experiments.

The chief features of the reports about what happened in skimming are as follows: *D* reported that she read the topic sentence² carefully and then followed down the sides of the paragraph, catching an important word occasionally and then following the sentence until the verb was reached. *Fr* attempted to

² The observers in these experiments meant by the "topic sentence,"—the one which contained the gist of the paragraph,—most often the first sentence in the paragraph.

force the pace by reading vertically, but found it could not be done, and finally hit upon the method of noting necessary "beads," i. e., important words, which occur at fairly regular distances apart (?); he says skimming is successful and easy if one can fit one's jumps of attention to this distance between important words. *Gou* read the topic sentences, and then, keeping these in mind, skimmed down the center of the page for new ideas of importance. She usually read some or all of the concluding sentences of paragraphs. *Gst* skipped from topic to topic, keeping the leading ones in mind, omitting the middle portions of sentences, and emphasizing nouns. *Sk* took note of the main words, that is, the more general ones, supplying the others. These reports will be generalized later, when the results of the main experiments are discussed.

MAIN EXPERIMENTS

In the main experiments Mangold's *Child Problems* was used as the material for reading; since its subject matter was about equally familiar to all the observers, its text is divided into sections of approximately equal length, and it was long enough to afford a good deal of material. The observers in this part of the investigation were *B*, *D*, *Fr*, *Gou*, *Gst*, and *Sk*. The method used was the same as in the previous work, except that after three selections (about two pages each) had been skimmed at a rate chosen by the subject, one selection was read at some other speed, as, for example, maximal silent. In all, twelve selections were skimmed. The results from these experiments are recorded in Tables 6, 7, and 8.

From the arithmetical results we may draw the following conclusions:

(1) The twelve passages appear to have been about equal in difficulty, since no one of them is found to stand uniformly high or low in the speed with which it was skimmed by the six readers (Table 6.)

(2) The speed of reading under these conditions is such that on the average 5.9 words are covered (not read, of course) per second, or one word each 0.169 sec. (Table 7.)

(3) Under instructions to skim there remain marked individual differences in the rate; thus, to cite extremes, *Gst* skims at nearly three times the pace of *Gou*; again, we note that *Fr* can read

TABLE 6
Twelve Passages Arranged in Order of Speed for Each Reader

B	D	Fr	Gou	Gst	Sk
7	10	4	6	4	5
8	3	5	3	2	1
4	7	7	1	6	4
12	8	10	5	1	8
6	9	1	8	5	11
10	1	9	9	9	7
2	11	12	4	10	10
11	12	2	7	12	9
9	2	6	12	7	12
3	4	11	10	11	6
5	6	3	11	3	2
1	5	8	2	8	3

TABLE 7
Average Time per Word in Skimming 12 Passages (in Sec.)

Reader	12 1st pages	12 2d pages	8 3d pages	General Aver.
B.....	.211	.154	.135	.171
D.....	.176	.150	.166	.164
Fr.....	.155	.157	.164	.158
Gou.....	.247	.233	.194	.228
Gst.....	.107	.097	.085	.097
Sk.....	.257	.210	.177	.199
Aver....	.192	.167	.153	.169

TABLE 8
Average Per Cent. of Reproduction for Each Selection Skimmed

	1	2	3	4	5	6	7	8	9	10	11	12	Av.
B.....	50	50	50	60	60	60	80	75	75	50	50	50	59
D.....	70	60	50	50	60	60	60	50	80	30	30	40	53
Fr.....	60	80	70	80	85	70	75	80	85	85	80	80	78
Gou.....	85	90	75	75	60	75	70	60	70	40	60	80	70
Gst.....	75	60	70	60	50	50	70	60	50	60	30	60	58
Sk.....	80	60	25	60	40	60	70	40	60	20	50	30	50

aloud (Table 4) faster than *Gou* skims silently in these passages (Table 7). In fact, it appears that *Gou* really does not succeed in achieving any noticeable increase of speed when directed to skim (her rate per word in normal silent reading is 0.24 sec. per word; in maximal speed aloud, 0.22 sec.; in skimming 0.228 sec.)

(4) By comparing the speed of skimming by pages, we find that it runs approximately 0.19 sec. per word for the first page, 0.17 sec. per word for the second page and 0.15 sec. per word in the third page (of the 8 passages that ran over two pages in length).³ The explanation is presumably in part general "warming up" to mental work, in part increase of ease of "skipping" in the later portions of the selections as the context "piled up" and supplied more and more material for guiding the reader.

³ The data from which these figures are derived are not shown in detail in any of our tables.

The following conclusions may be drawn from the statements of the observers as to their methods of skimming:

(1) All the observers, with the possible exception of *Fr*, read the greater part of the *first sentence*, "to get the 'run' of the thing."

(2) After this, skipping began, and now greater *individual variations* were found. *B* usually stopped in sentences after reading about half, or enough to determine whether the thought had been changed, and jumped practically all quotations. *D* read the first sentence, and then passed down the page, selecting words that seemed important, hesitating long enough to get their meaning in the sentence. She pronounced to herself only the important words. *Fr* read vertically, finding that two words usually gave the meaning of a line, took fairly large jumps, and noted a tendency to stop and read "slogans" and "catch-words." *Gou* believed that her eye movement was faster than in ordinary reading. She skipped usually just after getting a new and important point, moving the eye vertically at these times, trying to select anything important enough to be read, in part or entire. *Gst* skipped no entire sentences, but in reading the last thought of a sentence attempted to catch the opening phrase of the next, and then omitted it if it was not the thought wanted. He filled in a great deal from previous experience. *Sk* read "mostly the high places," attempting to read the outline of the selection and infer the remainder. Frequently, after glancing at the first few words of a phrase or sentence, he could judge whether or not to go on. In jumping from a sentence to several below, he found no particular criterion by which to determine where to begin again, sometimes starting in at a new paragraph and again at some particular word or phrase that he happened to see. In general, he read the first sentence of a selection and then enough of the succeeding sentences to find out whether or not they were essential or were merely elaborations or "filling-in" of the previous thought. If they were essential, enough was read to give the thought, and if not, a jump was made to the next sentence or phrase, and it received similar treatment.

(3) The observers differed in their treatment of the *last sentences* of a paragraph; *D* always read them, *Gst* never unless forced; the others sometimes read them and sometimes did not.

(4) The observers differed also in the discrimination used in rejecting certain parts of the material. *B* reported that he skipped

sentences referring to particular instances of laws, that is, those containing names of states, phrases whose sense was markedly supplementary, and quotations. He regarded quotations as "padding." *D* skipped sentences beginning with small words, or where there seemed to be no important words. *Fr* tried to skip minor details, but reported that he was really "too conscientious to be a good skimmer" and feared lest he might omit something important. *Gou*, after a new "important point," moved down the page until she found another important point. *Gst* skipped what seemed to be "filling-in" and details that were known. *Sk* skipped parts "not essential to the gist"—whenever he thought he could reason or infer the meaning without reading. Evidently, *B* used more logical discrimination in his skipping than did the other observers.

(5) The influence of *punctuation* was mentioned by *B*, *D*, and *Fr*; *B* reported that it was taken "on the jump," not exactly the mere marks, but the general spacing of the sentence. He found that the exclamation mark had tremendous attention-compelling power. *D* thought punctuation gave hints as to the importance of the material; she had a tendency to read material set off by quotation marks. *Fr* found the attraction of capitals and quotation marks so strong that he jumped directly to them. *Gst* said that punctuation marks did not exist for him, but he gave preference to short sentences, so probably he was affected by the spacing, at least. *Sk* mentioned capitals and italics. In general, there seemed to be a rather definite tendency for all observers to attend to proper nouns, italics,⁴ and quotation marks.

(6) There was a considerable amount of individual variation as to the *kinds of material* easy to skim, and difficult to skim. *B* could skim easily what was well-paragraphed, *D* what was tabulated, *Fr* if the "pitch"⁵ was fairly wide and successfully estimated near the beginning; *Gst* found it hard to skim what was interesting, while *Sk* found this easy.

From the preliminary experiments it was evident that condensed material is very hard—almost impossible—to skim; and that when the material is divided into paragraphs, it is easier to skim than if it is all in one paragraph. From the results of

⁴ Our observers differ from Titchener evidently in this and other respects.

⁵ "Pitch" apparently meant the amount of the skip or jump to be made, the distance from one essential idea to the next one.

some of the auxiliary work, it was evident that skimming was easier in material in which the first sentence of each paragraph was the topic sentence.

(7) There was a *tendency to glance back* at catch-phrases, italicized words, etc., or perhaps merely at the form or length of the paragraphs, to summarize the impressions gained. Doubtless the knowledge that a reproduction of the passage was to be demanded prompted this hasty retrospective glance. This tendency was shown particularly by *B*, *D*, *Gou*, and *Gst*.

(8) Certain notes made by the experimenter show differences in the forms of the reproductions. Thus *B* gave a logical paraphrase; *Fr* gave details and all in proper order; *Gou* gave her reproduction slowly but with evidence of the "logical schemas" which she was accustomed to make during the skimming; *Gst* often reproduced first the material which he had read last. *Fr* is a lip-reader and sometimes whispers the words.

(9) There are apparently different modes of rapid reading and skimming: (a) fast reading, in which every word is read, usually in kinaesthetic or auditory-kinaesthetic terms; (b) "trailing," which is "perceiving without apperceiving," catching impressions which may or may not be meaningful for the context—probably not in most cases; (c) "covering," like trailing, except that it may be either up and down or right and left, while trailing is the latter; (d) *omitting logically*, the procedure used when the first few words of a sentence are read and the observer decides it is unimportant and omits the rest; (e) *omitting arbitrarily*, as *Fr* did. (This observer, when starting a new selection, arbitrarily chose a size of "jump" which he thought fitted the material, and then took jumps of this size throughout, reading only those words which happened to come at the end of a jump.) Of the methods mentioned, *B* used (b) and (d), *D* (b) or (c), and (d), *Fr* (e), *Gou* (b)?, (c)?, (d), *Gst* (b) and (d), and *Sk* (b) and (d).

AUXILIARY EXPERIMENT 1

(Extra Fast Skimming)

From the results of the main experiments it was evident that the observers differed greatly in the speed of skimming (see Tables 4 and 7), and it therefore seemed advisable to discover, if possible, what would be the *effect of diminishing the time* allowed for the skimming, by forcing each observer to skim faster than he would naturally.

The observers who took part in this work were *D*, *Fr*, *Gou*, *Gst*, and *Sk*. The material was four educational reprints which contained, respectively, 3476, 1764, 1650, and 3360 words. Three minutes were allowed for skimming the first (the observer was warned at the expiration of each quarter of the time); one minute for the second; one minute for the third, and one minute and a half for the fourth. The rate of skimming was .05 per word for the first, .03 for the second, .04 for the third, and .03 for the fourth reprint.⁶

The following conclusions may be drawn from this experiment:

(1) Reproduction falls off when the observer is forced to read at these high speeds. *Gou* and *Fr* tried to get only the main points and skip the rest, while the other observers tried to trail over the whole thing and lost everything.

(2) In general, the first sentence of a paragraph is more likely to be read than the rest; italics are likely to be read, and fine print, such as that used for foot-notes, is almost sure to be omitted.

(3) The main points in the reports of the observers are as follows: *D* failed to get connected ideas, took larger jumps and read largely by italicized words and phrases rather than sentences—"did not like skimming so fast"; *Fr* read italics and quotations and guessed at the content of the paragraphs (a few supplementary experiments revealing that *Fr*, when instructed to skim as fast as possible, seemed to give up his system of arbitrary jumps and skim as the others did); *Gou* could not work out logical schemas as she did before, and could reproduce only the first sentence of paragraphs; *Gst* notices slight emotional disturbances, and found it hard to keep the logical sequence of ideas, and was able to reproduce practically nothing from the fastest passages; *Sk* got no sense out of the articles and noted only the first sentences of paragraphs or those which stood out because of quotation or question marks.

AUXILIARY EXPERIMENT 2

(Long Passages)

An additional experiment was carried out to see what would be the *effect of length of passage* on the rate of skimming. For this were used six educational reprints, varying in length from 2805

⁶ These rates may be compared with those for normal silent reading (roughly .20 to .30) and for the previous skimming (roughly .08 to .17).

to 6624 words. All observers except *B* took part. The method was the same as that used on the main experiments. The results given in Table 9 show that the rate of skimming quickened with the lengthening of the article to be skimmed. It should be noted, however, that this increase in speed may be almost entirely

TABLE 9
Average Speed of Skimming, in Sec. per Word, for Articles of Varying Length
(Articles A and B contained 3000 words, C 4000; D and E 5000; and F 6600, approximately.)

	A	B	C	D	E	F
D.....	.10	.16	.09	.09	.11	.05
Fr.....	.07	.08	.07	.05	.08	.07
Gou.....	.12	.17	.10	.12	.18	.14
Gst.....	.06	.09	.06	.05	.07	.05
Sk.....	.08	.20	.11	.06	.07	.06
Av.....	.12		.09	.09		.07

brought about by the observer's decision that he has already "taken in" all he can hold for the coming reproduction and that he will attempt to read nothing but the most important points on the later pages. *D*, losing interest toward the end of the passages, skipped a great deal there and felt that, in general, she skimmed in the same manner as in the shorter passages; *Fr* took longer steps; *Gou* thought she skipped more in skimming a long than a short article; *Gst*, when told in advance that the article was long, tended to hurry his skimming; *Sk* read less carefully in the longer selections and omitted much more of the material.

AUXILIARY EXPERIMENT 3

(Rates of Reading)

A last set of tests was carried out to determine more precisely than the conditions in the other experiments had permitted, the relations between the rates of reading by the five different methods. Here the material used was educational reprints.⁷ The observers were *D*, *Fr*, *Gou*, *Gst*, and *Sk*. The method was as follows: each reprint was divided in halves; the first half was then read by one of the five methods, the time recorded, etc.; then the second half was read by another of the methods. In

⁷ The following may be cited as examples of reprints used in this work: Kirkpatrick, "Child Study," *Pop. Sci. Mo.*, 1910; Ayres, "Psychological Tests in Vocational Guidance," this JOURNAL, 1913; Bagley, "Elective Studies in the High-School Curriculum," *Sch. Rev.*, 1908; Bingham, "The Use of Experiment in Teaching Educational Psychology," this JOURNAL, 1910.

all, 8 passages were read by each method; the same passage was never re-read. This general arrangement was designed to cancel out the effects of possible unevenness of the material.

TABLE 10

Average Time, in Seconds per Word, for Selections Read by the Five Methods

	Silent				Aloud				Skimming Time Rank	
	Normal Time Rank		Maximal Time Rank		Normal Time Rank		Maximal Time Rank			
D.....	.28	3	.25	3.5	.33	3	.27	2.5	.15	4
Fr.....	.19	2	.16	2	.27	1	.24	1	.12	2
Gou....	.32	4	.25	3.5	.40	4	.28	4	.17	5
Gst....	.13	1	.11	1	.32	2	.27	2.5	.08	1
Sk.....	.37	5	.32	5	.43	5	.37	5	.14	3
Av....	.26		.22		.35		.29		.13	

TABLE 11

Average Reproduction (on Scale of 100) for the Five Methods

	Silent				Aloud				Skimming	
	Normal % Rank		Maximal % Rank		Normal % Rank		Maximal % Rank			
D.....	76	3.5	72	3	75	3	76	4	73	3.5
Fr.....	89	1	89	1	98	1	85	1	81	2
Gou.....	84	2	84	2	81	2	83	3	86	1
Gst.....	76	3.5	71	4	74	4	84	2	73	3.5
Sk.....	65	5	60	5	51	5	58	5	50	5
Av.....	78		75		74		73		73	

Tables 10 to 12 show the results obtained. From them the following conclusions may be drawn:

(1) *Gst* is the fastest and *Fr* the next fastest silent reader; the same two observers are the fastest in reading aloud, both at normal and at maximal rates. *Sk* is slowest in all these modes of reading. As in the earlier tests *Gou* speeds up less in skimming than do the others.

(2) *Correlations for the speed of reading by the five methods* (calculated by the Pearson method) are as follows:

	r	P.E.
Normal silent and maximal silent.....	.70	.16
Normal silent and normal aloud.....	.66	.17
Normal silent and maximal aloud.....	.42	.25
Normal silent and skimming.....	.71	.16
Maximal silent and normal aloud.....	.63	.19
Maximal silent and maximal aloud.....	.65	.18
Maximal silent and skimming.....	.61	.19
Normal aloud and maximal aloud.....	.62	.19
Normal aloud and skimming.....	.41	.25
Maximal aloud and skimming.....	.28	.28

We find that there is greatest correlation between skimming-rate and rate for normal silent reading. Only the correlations which are several times the probable error should be considered significant.

(3) From the average time for all the observers we find that *the order of speed for the five methods* is: skimming, maximal silent, normal silent, maximal aloud, normal aloud. The only exceptions to this are *Gou* and *Sk*, both of whom average faster at maximal aloud than at normal silent. If we take the time for normal aloud, the slowest speed, as 100, then maximal aloud would be 83, normal silent 74, maximal silent 60, and skimming 40. If we take normal silent as 100, then normal aloud would be 135, maximal aloud 112, maximal silent 81, and skimming 54.

(4) *Fr* and *Gou* are the best reproducers, and *Sk* the poorest. In comparing (1) and (4) we find that one of the fastest readers is one of the best reproducers, and that the slowest reader is the poorest reproducer, which is what we should have expected in consideration of the results obtained by Abell (*Educational Review*, 8, 1894: 283), Dearborn (*Psychology of Reading*), Huey (*Psychology and Pedagogy of Reading*), and Quantz (*Problems in the Psychology of Reading*). There are, however, two exceptions to this general rule, *Gou* and *Gst*, for *Gou* is one of the best reproducers and one of the slowest readers, while *Gst* is a very fast reader and not a particularly good reproducer.⁸

(5) From the average reproduction, we find that the *reproduction* is likely to be better for normal silent than for any other speeds. (Exceptions: *Gou* best for skimming; *Gst* best for maximal aloud.)

(6) From the mean variations (Table 12) there is least *variation* in the speed of normal aloud, and most for skimming.

(7) The mean variations for the different observers show that in general, *Fr* and *Gst* were most, and *D* and *Gou* least variable.

(8) From inspection of the average time taken to read the various selections and of the mean variations for each speed, we may conclude that the *material was fairly uniform in difficulty*.

⁸ There seems to be an explanation of this paradox. It will be remembered that *Gou* proved to be greatly affected in speed by the necessity of reproducing at the end. It therefore seems probable that, either voluntarily or involuntarily, she slowed down her speed in order to make a better reproduction at the end, while the other observers did not do this. If *Gou* had worked under exactly the same conditions as the others, there might have been a change in her position as a reproducer, in which case the position of *Gst* would have been moved up and the results would have been more nearly what we should have expected.

TABLE 12

Per Cent. Mean Variation for the Various Observers in Time per Word for the Five Methods

	Silent				Aloud				Skimming	
	Normal % Rank		Maximal % Rank		Normal % Rank		Maximal % Rank			
D.....	14.29	4	8.00	5	6.06	5	11.11	2.5	20.00	2
Fr.....	21.05	1	12.50	2.5	14.07	1	12.50	1	16.67	3
Gou.....	18.75	2	12.00	4	10.00	3	7.14	5	11.76	5
Gst.....	15.38	3	18.18	1	12.50	2	11.11	2.5	12.50	4
Sk.....	13.51	5	12.50	2.5	6.98	4	10.81	4	22.22	1
Av.....	13.60		12.64		9.92		10.53		16.63	

CONCLUSION

The principal factual conclusions of our experimentation have already been presented in the summary that precedes the article. It remains only to remind the reader that our study has been limited to a small group of adult readers, all college-trained and all somewhat familiar with the subject matter read. However, without risking generalization we can at least say that our study has indicated methods that may be employed and probably fore-shadowed some of the general outcomes that may be expected in a more comprehensive survey of the problem. We would suggest that a fruitful extension of the present investigation would be the application of similar methods to a group of children of perhaps different pedagogical and different mental levels, with special reference to the effect of practice and to the limitations placed upon skimming by degree of general intelligence and range of information, or special familiarity with the subject matter employed.

In the absence of evidence to the contrary we are disposed to think that systematic drill in skimming is desirable for children that have mastered the mechanics of reading and that are using reading regularly as a tool for the acquisition of knowledge.

THE INFLUENCE OF SPEED DRILLS UPON THE RATE AND THE EFFECTIVENESS OF SILENT READING

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Within recent years the psychology of reading has been intensively studied by a considerable number of investigators, among whom the following persons have made valuable contributions to the subject: Erdmann and Dodge at Halle in 1908, Dodge at Wesleyan in 1900, Dearborn at Columbia in 1906,¹ Whipple at Cornell, Briggs at Columbia,¹ Pintner,² and especially Huey (1907) in his important work on the Psychology of Reading, and Laing (1909) in "The Teaching of Reading." Since that time a number of experiments have been made on silent as compared with oral reading, the most important of which were the Kansas Silent Reading Tests. One of the products of this study has been the discovery that persons differ very widely in the rate at which they read, the difference being frequently three or four to one, and in extreme cases even more. But the most surprising fact discovered is that rapid reading need not be superficial reading. Indeed all investigators agree that the rapid readers are, as a rule, the most effective readers. Thus Briggs of Columbia had two persons read Silas Marner, one of whom was able to read 156 pages in an hour and the other only 16. But when ten test questions were given to both on the content of the work read the rapid reader was able to answer them all intelligently while the slow reader could not answer a single one. Klapper quotes from Quantz as follows: "A comparison between the ten most rapid readers and the ten slowest readers shows that the rapid readers remember more of the original thoughts, and that the character of their reproduction is much higher, both generally and with reference to expression and logical content. In the auditory tests the ratio of slow to rapid readers is 14.8 per cent. to 20.7 per cent. in the number of thoughts. In quality the percentages are 48.7 per cent. for slow readers, 60.3 per cent. for fast. The same comparison in the visual tests results as follows: Percentage of thoughts reproduced by slow readers, 14.9; by rapid, 24.4. Quality: slow, 48 per cent.; rapid, 73.3

¹ See Education, 1912 and 1913, for these articles.

² PINTNER, *Oral and Silent Reading*, Journal of Ed. Psy., 4: 333.

per cent. The difference in favor of the rapid readers is consequently much greater than in auditory tests, indicating again that rapid readers are, as a rule, of the visual type."³

In view of this manifest advantage from rapidity in reading a number of these psychologists urge that, in our teaching, we strive to cultivate it. Our present methods of teaching reading, Professor Whipple thinks, are of such a character as to develop plodding habits of reading, and in consequence sluggish habits of thinking. Professor Klapper also thinks that we must get away from our "Fetish of Oral Reading" and work definitely for "(1) speed, (2) accuracy, and (3) direct association between printed symbol and idea."⁴ Laing remarks that "All writers agree that through practice the span of attention (an important element in rapidity in reading) may be increased," Briggs urges the seeking of speed, and Dearborn says, "What may be called speed tests ought on this account to have some place in school methods of teaching reading, as well as in other subjects in which alertness of attention is demanded and cultivated."

But that this ability to read more rapidly could be cultivated had never been demonstrated.⁵ There was some reason to believe that it is a native characteristic rather than one due to training. It was certain that rapidity and mental alertness went together but which was cause and which effect had not been ascertained.⁶ All of the experiments performed by the psychologists were of a static rather than a dynamic character. They took their subjects at a single stage and compared them with others taken also at a single stage. Moreover the experiments were nearly all performed upon adults, only one or two having to do with children as young as nine years old.⁷ To assume from these static experiments that the recommended speed drills would, under ordinary school conditions, be a factor in developing rapidity and attendant effectiveness was a purely

³ *Teaching Children to Read*, page 23.

⁴ *Teaching Children to Read*, page 23.

⁵ Professor Freeman quotes an unpublished thesis by K. D. Waldo in defense of this supposition. But Professor Freeman's tables are not sufficiently complete to indicate whether or not precautions were taken by Waldo to distinguish the result of speed drills from that due to such development as is to be expected through a school year. (*Psy. of Common Branches*, page 90.)

⁶ On one side of this question see Freeman, "*Psy. of Common Branches*," pp. 89-90; on the opposite side see Irving King, "A Comparison of Slow and Rapid Readers," *School and Society*, Nov. 25, 1916, pp. 830-34.

⁷ Recent experiments have, of course, dealt with school children.

a priori inference, so far as I could learn. No trace could be found of any experiment to determine it. It was to empirically test the actual effect of such effort that the following experiment was planned.

In undertaking the experiment the writer hesitated between two methods of working for speed. Should it be by simple speed drills or should there be an effort to control the fixation points? The Psychology of Reading seemed to favor the latter. It was known that rapid readers differ from slow ones very largely in the number of pauses, or fixations of attention and eye direction, which they make in each line. The slow readers make many and irregular fixations; the rapid readers, few and rhythmic ones. It appeared desirable, therefore, to control the place and the number of fixations per line on the part of the reader. The feasibility of determining these points by some sort of marks, or by sweeps of a pointer, or by appropriate spacing, was considered. In addition to their fewness and regularity thus secured the shortening of the period of these fixations, by some device, to the minimum necessary for comprehension was considered. That these fixations should be as short as possible is indicated by the discovery of Cattell, Quantz and others, that when reading matter is exposed for one one-hundredth of a second more of it can be read than when exposed for a somewhat longer time.

But it was also known that interest in the matter read, and an interest in proceeding as rapidly as possible, will alone drag on the fixation points to a greater distance and make their period shorter. Besides it was not established that there is any one optimum length of interval, the evidence indicating that this interval differs for even the same individual according to the subject matter read. It seemed plausible, therefore, that the eye movements would fall of themselves into their best type of rhythm for the particular individual and for the particular subject matter read if no attempt were made to control them from without. Besides it was feared that such devices as would be necessary to control the fixation points would distract attention so much, particularly at first, as to seriously interfere with reading by the young children who were to be experimented upon. It was therefore decided to make no effort to control fixation points by mechanical devices but to rely upon interest in the matter read and, especially, upon the request to get the matter

read as quickly as possible, together with such atmosphere about the room as would encourage speed without producing such undue excitement as would lead to superficial reading. It would, however, be worth while to try this same experiment with the added effort to specifically control the number and the nature of the fixation points.

THE EXPERIMENT

Our experiment thus narrowed itself down to the specific one of ascertaining the influence upon speed and effectiveness of silent reading from daily speed drills, with oral reproduction, conducted through a period of seven months.

The experiment was carried on in the public schools of Royersford, Pa., during the academic year 1914-15. The writer was at that time supervising principal there. The experiment was made in grades three to six inclusive, though the results of the third grade are not included in the summary of results, for reasons to be discussed later. They are tabulated separately. There were used in the experiment six different teachers and two hundred and seven different pupils. The grades indicated above were chosen because reading receives in them a considerable amount of attention, and because the children here have reached the point in their training where such proportionately great changes in individuality as those of their earlier school years are not to be expected. It was originally the intention to include also grades one and two, but the extreme instability which we discovered in these grades made it advisable to drop them. Our experiment made it necessary to divide these grades into two groups each, as nearly equal as possible. But we soon discovered that, however nearly equal they were in the beginning of the year, forces altogether outside of the experiment might carry them far apart before the year had worn on long when they are so unstable in character as first and second grade pupils necessarily are.

Of the grades that remained there was a teacher for each—third, fourth, fifth and sixth—in one building, and a teacher for the third and fourth together and a second teacher for the fifth and sixth together in another building. Those that had a teacher to each grade were ideally ordered for an experiment. In each of these the pupils were divided into two groups, as nearly equal in numbers and ability as convenient. Then a test, such as those described below, was given in each room, with all essential

conditions carefully kept uniform. Papers were then graded in the manner indicated below, and the group which showed the least speed chosen, when feasible, as the one to receive the drill. Exactly the same test was given, at the same time and with the same attendant conditions, in the two rooms in the other building. In these rooms, however, the pupils of each grade were kept as a single group. Thus for each grade there were three groups, two of which were given the speed drills and one of which was not. The effect of the drill was thus sought by comparing the two groups in each grade which had the drill with the one group which did not.

METHOD OF CONDUCTING DRILL

The groups which were not to have the speed drills, and which were to be used as a basis for comparison with those which did have, were dealt with after the usual fashion in teaching reading. The other groups, in addition to their oral reading, were given daily speed drills, without, however, giving a total of any more time to their reading than the other group received. So far as feasible both groups were taught reading at about the same time of day, or else at equally desirable periods. They used the same books and the same degree of enthusiasm was expected to be put into both. The drills were, of course, conducted by the teacher in charge of the class, and ran from November 7th to June 2nd. They were on relatively easy reading matter, and mostly interesting narrative. They occupied ordinarily from five to ten minutes of the reading period. The group as a whole was told explicitly where to begin and how far to read, and were then all set to silent reading at the same time with the exhortation to see who could get it read first. After all, or nearly all, had finished someone was asked to tell the substance of what he had read. If, in this reproduction, he omitted anything he was questioned on it as a guarantee against skimming.

THE TESTS

Tests were given to both groups on November 6th, January 20th, April 20th, and June 2nd. It was originally intended to give a test at intervals of two school months but when we came, on this basis, to the third test nearly half of our pupils were out with mumps and it was necessary to hold it over about

two weeks until most of the students were back. However, as nearly all of the pupils were out the three weeks quarantine period sometime during the second interval, the amount of practice received in it was approximately the same as in the first interval. However, it cut the length of the last interval to six weeks. These tests were conducted by the teachers in charge of the classes. As the teachers had given the drill, and as the tests were of somewhat the same character, it was thought that their conduct of them would be less of a disturbing factor. Besides, the necessity for conducting them all on the same day and at approximately the same hour made it impossible for the experimenter himself to hold them.

In each case the test consisted of two parts, given on successive days. The first of these parts consisted in the reading of a selection of from eighty to three hundred words with written reproduction of the substance of what had been read; the second, of the reading of directions to perform some act and then the carrying out, on the part of the reader, of those directions. For these tests children were taken in groups of six, so as to permit of an exact record of the time required for each individual to complete the reading. Books were kept closed, or papers turned upside down, while the teacher explained carefully what was to be done and taught any new or difficult words that might appear in the selection, without, however, indicating that they were to appear in this reading. When everything was ready all in the group of six were set to reading at the same time and as they finished they so indicated by raising their hands, closing their books or turning over their papers, and permitting the teacher to record the time. Every effort was made to keep all conditions constant during these tests.

The reading selections used in the tests were in every case narrative in form and somewhat easier than the usual reading for the grade in question. This was done to secure maximum interest, to make reproduction relatively easy, and to permit of the certain employment of any speed for which the pupil might have developed the ability. Different selections were used for the different grades. Stories which we believed the children had never read before were used in every test except the last, when lack of suitable material made it necessary to use matter, in one or two of the grades, which they had read not

less than a year before. Where possible a selection that was complete within the length of a page, or a page and a half, was sought, though we were sometimes obliged to use only parts of stories. We looked for material that was interesting but not so much so as to produce a disturbing amount of emotional strain. Normal print was sought and paragraphs which had their lines broken on account of pictures on the page were avoided.

In the second type of test the task set was in each case the drawing of some object for which directions were given. Here the procedure was the same as indicated above, except that the matter was the same in all the grades, except in the first test when it was somewhat simplified for the lower grades. Care was taken to set for drawing some object which was familiar to every child taking the tests—no easy thing to do, as the experimenter soon discovered. Something was also sought that represented a considerable degree of internal unity, so as to make the execution of the directions reasonably easy, but yet not so much of a unity as to make it possible to draw it without having read all the way through the directions. The directions were extended, by a little padding, to such length as would make it convenient to measure the time without making it so hard to read or carry in mind as to interfere with its purpose. To further facilitate memory a brief review of directions was usually given at the end and invariably the selection closed with some catch sentence, without which the drawing could not be complete, and which would therefore serve as a guarantee that it had been read all the way through. These selections were typewritten, double spaced, and with lines of about seven words in length, such length appearing to about balance the matter as compared to print in books. Care was taken to make all copies alike in all mechanical respects. Three copies were made at a time

DIRECTIONS

No. 1

Draw a square on your paper. A square is a figure with four straight lines as sides. These lines are all of the same length and the four corners are all alike. This ceiling would be a square if it were just as wide as it is long. After you have made the square place a dot right in the middle of it. Be careful to place the dot exactly in the middle. Then draw lines from this dot to each of the corners. That will take four lines. Be sure to make all the lines straight. Remember you are first to draw a square, then place a dot in the middle of it, and then draw lines from this dot to each of the four corners. When you have done this count all the lines and write the number of them on your paper.

No. 2

Draw a house. Make your house two stories high. In the front of the house, on the first story, put a door in the middle and a window on each side. In the upper story put three windows. One of these should be above the door and the others above the windows of the first story. You will find out that this will make your house look best.

Put a fence in front of the house with a gate in it. Mark the path which leads from this gate up to the front door. Remember you are to draw a house, make it two stories high, put a door and two windows below and three windows above, put a fence with a gate in front of it, and mark the path which leads from the gate to the door.

No. 3

Draw a boy's face. Just make a round ring for the head. Not every boy has a round face but a ring will do for this boy. Then put in lines for the nose, the mouth, the two eyes, and the two ears. Also mark his hair. Put some sort of a hat on him. But do not put any body to him. Remember you are to make only a round ring for a head, put in eyes, nose, mouth, ears, and hair, put on a hat, but put no body to the head. Write the boy's name under the face.

No. 4

Draw a bridge across a river. We will suppose that no big boats go up and down this river, so we can put as many posts as we please between the ends of our bridge for it to rest upon. Then, you know, a good bridge must have an iron fence along each side to keep people from falling off. Our bridge must have such a fence. Many people, too, cross a bridge, and ours would not look well unless it showed some of them. But you need not try to draw in their faces. Just a straight stroke would do for each man. Put four such men on the bridge in your picture.

No. 5

Draw a tree as you would see it in winter. You know there are no leaves on the trees in the winter. The leaves grow out in the Spring and drop off in the Fall. Draw five limbs on each side of the trunk of your tree. Make the lower limbs longer than those at the top, as this will make your tree look better. Now, you know, birds often sit on trees. Of course, in winter most birds have gone away, but a few stay here. So mark on your tree three small birds where you think they would sit.

and the same number of carbon copies given to each group. Samples of these directions accompany this paper.⁸

MARKING THE PAPERS

The teachers graded the papers. In the reading selections the experimenter indicated the number of thoughts which the selection seemed to contain, and this was made the basis for assigning a percentage to each pupil. The papers were marked for quality of reproduction as well as quantity (in separate grades) but the element of judgment entered so largely into the marks for quality, with the attendant unreliability for scientific purposes, that no use was made of these marks, only the ones for quantity appearing in the tables. In the lower grades it was an easy matter to separate a selection into its distinct thoughts and to find these thoughts either present or absent in

⁸ As this experiment was conducted before the Kansas Silent Reading Tests we could not profit by suggestions regarding technique which these tests have made.

the papers and mark them accordingly. In the higher grades, however, this could not be done with nearly as great definiteness and here the teachers were forced to rely partly upon an estimate of the completeness of the paper. This may have introduced a varying condition when the group under one teacher was compared with that under another, though it probably counted for little when both groups were under the same teacher. In the drawing papers grades were also assigned to the papers according to the extent to which the pupil had understood and followed the instructions. Thus the work of each pupil was recorded as to time, which indicated the speed with which he could read, and as to quantity of reproduction, which indicated the effectiveness of his reading. In the tables which follow speed is reduced to number of words per minute.

COMPUTATION OF RESULTS

The first tests, given at the beginning of the experiment (Nov. 6 and 7) were used to ascertain the degree of equality between the two groups—the “drill” and the “no-drill” groups; the others to measure their degree of equality as the experiment proceeded. All pupils who were absent in any one of the tests were eliminated, except that in two cases where pupils had missed only one half a test (for example the drawing, but not the reading) their grades were computed, on the basis of their results in other tests as compared with the average, and inserted. All persons who were abnormal—either unusually rapid or unusually slow—were also eliminated. In addition the whole of the third grade was eliminated in making the summaries. This was because the drill group in the room with both groups was so small as to make its results unreliable (only five, after eliminations) and because it would therefore have been necessary to depend almost entirely upon a drill group under one teacher and a no-drill group under another. With children so susceptible to the varying abilities of teachers as third grade pupils it seemed best not to include this grade in the general summaries. The results in this grade are given in the tables, though not included in the summaries.

After eliminations there remained, out of the original two hundred and seven, one hundred and thirty-seven in the fourth, fifth and sixth grades and forty-three in the third grade. Thus twenty-seven were eliminated on account of absence or of some abnormality.

RESULTS

The following summaries indicate the results of the four tests. The summaries are also shown in graphical form on charts accompanying this paper. In indicating the rooms the numbers refer to grades, a and w distinguish buildings (w had both drill and no-drill groups while a had only drill groups), and d and n stand respectively for "drill" and "no-drill." All averages are weighted.

TABLE 1
Speed in Reading

Room	Nov. 6	Jan. 20	Apr. 20	June 2
3wn.....	107.6	78.3	165	135.5
3wd.....	105.2	93.5	189	162.6
3ad.....	114.8	126	214	216.4
4wd.....	110.4	252	259	256
4wn.....	126	230	295	199.6
4ad.....	119	320	198	247
5wd.....	256	254.5	288	321.2
5wn.....	269	264	277	294
5ad.....	155	245	236	247.2
6wd.....	164.5	262	179	310
6wn.....	224.5	254	180	315
6ad.....	270	272	137	265
SUMMARY— drill....	167.7	266.5	219.8	261.4
SUMMARY— no-drill...	201.1	248	253.8	264.9

Speed in Drawing Tests

4wd.....	314	275	280	159
4wn.....	329	255	268	160
4ad.....	181	171	184	177
5wd.....	181.6	189	315	262.4
5wn.....	287	254	283	257
5ad.....	185	209	262	221
6wd.....	221.2	237.7	257	254
6wn.....	273	217	258	234
6ad.....	178	206	222	223
SUMMARY— drill....	218.3	218.7	253	209.8
SUMMARY— no-drill...	274.2	242.9	267.3	213.2

Speed in Drawing and Reading Combined

Average drill g....	193	242.6	236.4	235.6
Av. no- drill g....	237.6	245.4	260.5	239

Quantity of Reproduction in Reading

3wd.....	48.6	91.4	88.5	70
3wn.....	47.6	61	77	89.2
3ad.....	56	58	65.8	71
4wd.....	73	80	78.6	82.4
4wn.....	75.3	71.1	78	82.3
4ad.....	62	84.4	78	73
5wd.....	78	65.7	90	92
5wn.....	72.5	62	88	85.2
5ad.....	68	70	87.6	73.4
6wd.....	58	63	67.3	81.4
6wn.....	57	58	65	74
6ad.....	84	81	50	89.2
SUMMARY— drill.....	69.7	72.2	76.4	81
SUMMARY— no-drill...	68.7	64.2	77.1	80.6

Quality in Drawing

4wd.....	73.9	62.9	67.3	89.2
4wn.....	64.4	70.1	69	92.1
4ad.....	74.7	94	94.4	96
5wd.....	95	95	94	91
5wn.....	94.4	98.2	89	86.5
5ad.....	84	78	91	92.5
6wd.....	96.7	96	98.6	88.3
6wn.....	91	93	97.5	92.1
6ad.....	92	84	90	96
SUMMARY— drill.....	84.4	83.4	87.7	92.2
SUMMARY— no-drill...	82	85.9	84.1	90.7

Quality, Reading and Drawing Combined

Average drill g....	77	78.8	81.5	86.6
Av. no- drill g....	75.3	75	80.6	85.6

The following table shows the relative gain or loss of the drill group as compared with the no-drill group and their distribution throughout the three intervals through which the experiment ran:

TABLE II.

	1st period	2nd period	3rd period	Total
No. of cases of relative gain in speed.....	16	4	8	22
No. of cases of relative loss in speed.....	2	8	4	14
No. of cases of relative gain in quality.....	5	3	5	13
No. of cases of relative loss in quality.....	7	9	7	23
No. of cases of simultaneous gain in both speed and quality.....	5	2	4	11
No. of cases of simultaneous loss in both speed and quality.....	2	7	3	12
No. of cases of inverse relation in speed and quality.....	5	3	5	13

The above table shows a surplus of cases of gain over cases of loss in speed and hence speaks for the value of the speed drills from that standpoint. It will be noticed that the number of cases of relative gain decreases from the first period to the third while the number of cases of relative loss increases. This is due to the fact that the gains were made largely in the early part of the training period. Thereafter, if the drill group failed, at any test period, to hold all of the advantage which the last test indicated that it had gained the relative drop counted as a loss, even though, compared with the initial relation between the groups, the drill group still retained a significant net gain. Consequently these intermediate relative gains and losses have little significance. They show only where the gains are just about overbalanced by losses. The real story is told by a comparison of the conditions at the beginning with that at the end of the whole training period. In consequence the following table represents the situation more correctly. It gives the number of cases of relative gain or loss in the several periods compared always with the relative standing of the groups at the beginning of the experiment.

	1st period	2nd period	3rd period	Total
No. of cases of relative gain in speed.....	10	9	11	30
No. of cases of relative loss in speed.....	2	3	1	6
No. of cases of relative gain in quality.....	5	7	7	19
No. of cases of relative loss in quality.....	7	5	5	17
No. of cases of simultaneous gain in both.....	5	6	7	18
No. of cases of simultaneous loss in both.....	2	1	0	3
No. of cases of inverse variation.....	5	5	5	15

The single case of net relative loss in speed in the last period on the part of the drill group as compared with the no-drill group was an instance where a group in one building, under one teacher,

was compared with a group in another building under another teacher, and where, consequently, conditions were unpropitious for experiment. Even there the loss was very slight.

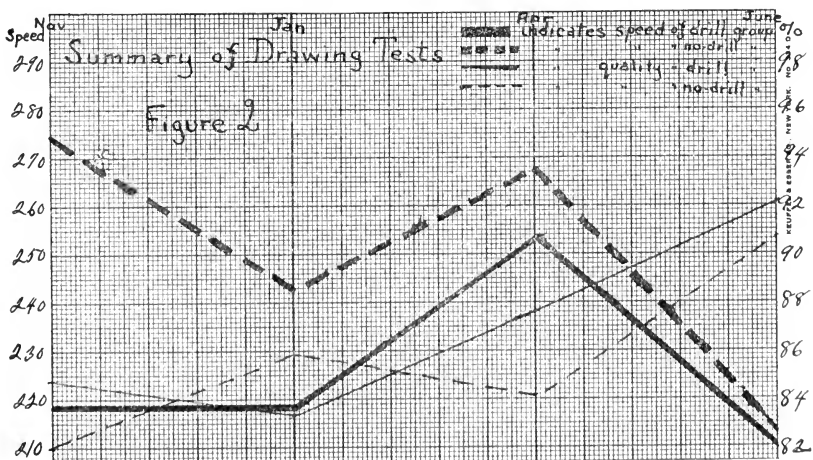
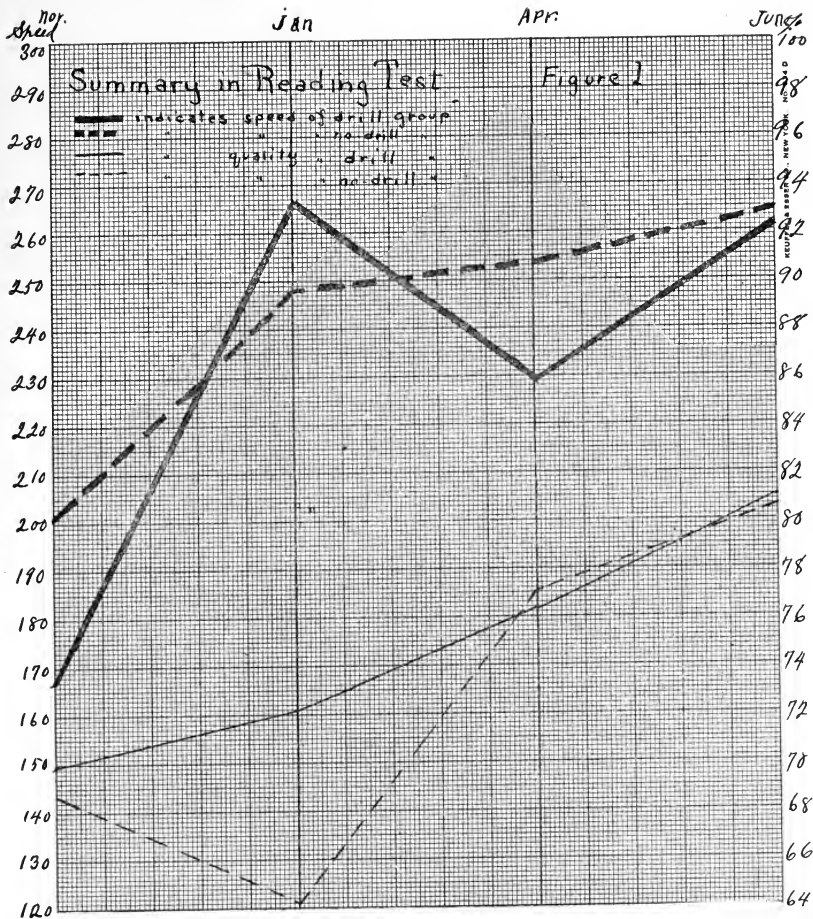
The following table summarizes in convenient form the results of the experiment. The relation between the groups at each stage is expressed in per cent., in which the work of the no-drill group is used as the base. Thus under speed in reading the table indicates that the drill group could read 83.8% as rapidly as the no-drill in the beginning, 107.5% as rapidly after two months, etc. This table shows a relative gain of 18.7% in speed but a trifling loss in quality as the result of the speed drills.

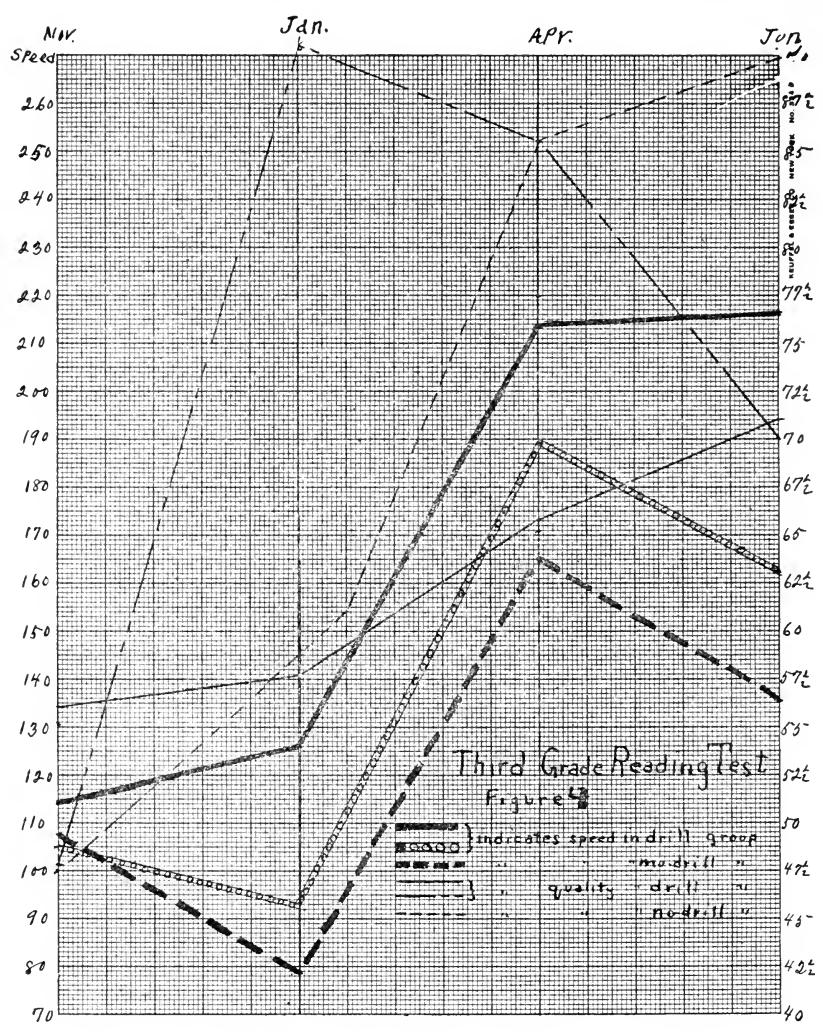
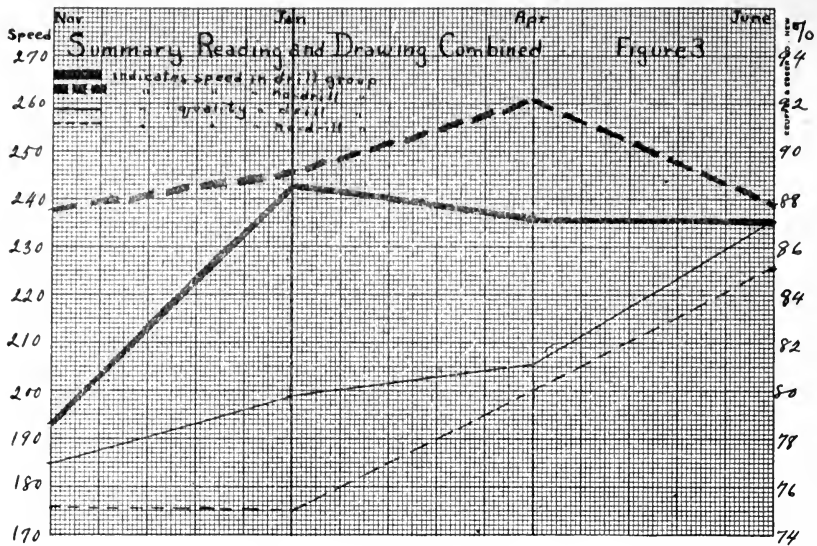
	1st test	2nd test	3rd test	4th test	gain
		<i>Speed</i>			
Reading test.....	83.5	107.5	86.6	98.7	14.9
Drawing test.....	76	90	94.6	98.4	22.4
Total.....	79.9	98.7	90.6	98.6	18.7
		<i>Quality</i>			
Reading test.....	101.5	112.4	99.1	100.5	—1
Drawing test.....	102.9	97.1	104.3	101.7	—1.2
Total.....	102.2	105.1	101.1	101.1	—1.1

OBSERVATIONS ON THE EXPERIMENT

1. The comparison between groups in different buildings, and under different teachers, is by no means ideal for experiment. It does not insure that all factors besides the one experimented upon remain constant. Altogether apart from the effect of the specific drills pupils may, under such diverse conditions, make different degrees of progress. Hence those cases in this experiment which compare two groups under the same teacher are the more trustworthy.

2. It was not possible to keep conditions absolutely constant even through the tests. For these tests consumed over an hour in time, and the degree of fatigue doubtless varied somewhat within as long a period as that. Hence the group tested first may have been either more or less alert than the group tested second. Besides the fact that the test had been running for some time in the room would tend to make it monotonous, or otherwise different, and this may have affected the results. It occurred to me afterwards that this disturbing factor might have been reduced to a minimum by taking sections alternately out of the drill and the no-drill groups, instead of testing all of the one group first and all of the other group later. This, however, was not thought of in time.





3. A peculiar departure from the general trend of the results of the experiment occurs in the showing of the third test. Here the drill group loses on the average almost as much as it had gained in the first period and simultaneously loses in quality. There are eight cases of relative loss in speed in reading against four of gain, while in the other two periods this proportion is reversed or better. The quality fares almost equally badly. Indeed there are seven cases of simultaneous loss of speed and quality here while there were only two in the first period and three in the last. It was during the preceding period that a large proportion of the pupils were out with contagious diseases, but a study of the aggregate number of days missed by both groups showed that the no-drill group missed not less but slightly more time than the drill group, so that that could not explain the matter. Another factor which might possibly have some bearing was the fact that the teacher in the room departing most widely from the expected was called out of the room for a short time while the test was in progress, but, from studying carefully the attendant conditions, we could not convince ourselves that that could have seriously affected the results. But I suspect that the true explanation lies in a difference in our mode of approaching this test as compared with the others. In earlier tests pupils were allowed to read normally. They were not urged to go rapidly. In this third test, however, by the advice of the seminar,⁹ all pupils were urged, when they sat down to the test, to read as rapidly as possible. It is true that this exhortation was given to both groups but, in as much as it was new to the no-drill group and an everyday occurrence to the drill group, it may have acted as a more effective spur to the former than to the latter, and thus unbalanced the conditions. If this is the correct explanation it emphasizes two things: first, the great extent to which both speed and effectiveness of reading respond to added effort, and, second, the extreme caution which an experimenter must exercise to keep conditions constant in his two groups. What appears to be but a trivial matter may really be of enough consequence to vitiate the whole experiment.

4. An examination of the data given for the third grade (not included in the summaries) shows a decided gain in speed (22.5%)

⁹ The seminar in Educational Research conducted by Professor Yocum at the University of Pennsylvania, of which the writer was a member at the time.

but also a considerable loss in quality (14.7%). This may indicate that the habit of reading rapidly is most easily formed at this early age, but that this rapidity is gained at the expense of accuracy, or it may be due merely to the untrustworthy conditions which attended this part of the experiment, as noted before.

5. This experiment has not confirmed the doctrine that increase in speed will carry with it, in any given individual, also increase in effectiveness.¹⁰ It is not improbable that differences in reading speed are only indicative of more fundamental differences¹¹—differences in sluggishness of thinking—and that the best that can be done, as the result of speed drills, is to bring up the speed more nearly to the possibilities of the particular individual, but that the naturally slow reader can not be developed into a rapid one without impairing his effectiveness. Whether, and how, slow readers differ from fast ones in their mental characteristics needs to be determined by experiment.

6. It is not improbable that an added effort to control the mechanics of reading—that is eye movements—would show even better results in speed. It is also probable that it is worth while to teach children to “skim.” That must be determined by separate experiments. But the present investigation, showing a relative improvement of 18.7% in speed, without injuriously affecting the quality, as the result of the drills, strongly suggests the advisability of giving speed drills as a part of the teaching of reading.

¹⁰ For an account of an experiment which seems to confirm this one see IRVING KING, *A Comparison of Slow and Rapid Readers*, School and Society, Nov. 25, 1916, pp. 830-4.

¹¹ Thorndike found this true of speed and accuracy in arithmetical processes. See *Journal of Educational Psychology*, Feb., 1914.

COMMUNICATIONS AND DISCUSSIONS

RESULTS IN SILENT VERSUS ORAL READING

The June, 1915, JOURNAL OF EDUCATIONAL PSYCHOLOGY gave the results in silent and oral reading with one hundred and twelve sixth-grade pupils of the Cincinnati schools tested in May, 1914. The purpose was to find by which method pupils were able to reproduce the more points included in the "Alice in Wonderland" material read. If they read more lines silently than orally, would they not only reproduce more points, but would they be able to reproduce a greater per cent. of possible points covered? Six two-minute tests were given in each of the methods of reading. Without exception, each class (five) reproduced a greater percentage of possible points by the silent method. Seventy-one per cent. of the children taken separately did better by this method.

In May, 1915 and 1916, the same tests were conducted with three hundred and forty pupils from the third to the tenth grade, the ninth not included. These tests were identical in every way with the above except that each of the six in 1915 and 1916 was for one minute instead of two as in the case of the one hundred and twelve sixth-grade pupils. Fifteen out of seventeen classes did better by the silent method of reading. Seventy per cent. of the children taken separately did better by this method. The results by grades are given in Table I. The last column shows the per cent. of points each pupil did better by the silent method of reading.

CYRUS D. MEAD

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TABLE I.
Silent Versus Oral Reading
 May, 1915 and 1916
 (Six One-Minute Tests)

Grade	No.	<i>Silent</i>					<i>Oral</i>			
		Aver. Years	Aver. No. Lines Rd.	Aver. No. Pts. Repd.	Per Cent. Pts. Repd. of Pts. Read	Aver. No. Lines Rd.	Aver. No. Pts. Repd.	Per Cent. Pts. Repd. of Pts. Read	Per Cent. Difference Oral as Base	
									Total	Average
3	20	9.2	17.04	6.4	34.2	14.6	5.7	33.9	7.0	.35
4	20	10.1	27.0	7.2	23.9	17.4	8.7	35.0	-223.2	-11.1
5	18	11.1	15.7	7.9	45.57	13.1	5.86	39.38	111.4	6.19
5	21	11.9	25.5	11.7	43.1	20.3	8.5	36.2	143.8	6.8
5	21	11.4	25.2	9.9	35.7	18.38	6.6	30.19	114.	5.5
6	20	13.2	24.8	8.2	29.7	20.4	6.5	24.9	96.7	4.8
6	16	13.2	22.5	11.06	44.38	18.1	9.65	43.52	13.6	.85
6	20	11.7	29.5	14.2	45.1	22.5	11.3	46.0	-18.1	-9.05
7	20	13.0	21.4	10.6	45.4	19.6	9.6	43.8	35.4	1.7
7	20	13.3	27.1	10.8	37.3	19.8	7.5	33.5	74.6	3.7
8	20	13.8	23.4	10.3	38.0	22.0	7.6	30.4	158.	6.9
8	20	15.0	31.1	22.5	66.0	24.2	15.8	51.4	283.0	14.6
8	20	13.4	26.0	16.7	56.9	23.0	14.5	54.3	52.4	2.6
8	20	14.1	22.7	13.7	58.0	22.8	11.5	45.3	254.0	12.7
8	20	13.8	23.2	13.6	55.1	20.2	11.7	50.5	93.1	4.6
8	21	14.0	25.6	13.3	46.7	23.0	10.1	39.8	146.0	6.85
10	20	16.0	21.2	13.8	56.6	20.3	11.8	49.7	139.9	6.99

The last column shows the per cent. of points each pupil did better by the silent method.

ABSTRACTS AND REVIEWS

RECENT LITERATURE ON READING

1. WILLIAM ANTON SCHMIDT. *An Experimental Study in the Psychology of Reading*. Supplementary Educational Monographs. Vol. 1, No. 2, April, 1917. Chicago: University of Chicago Press. Pp. iv, 126. Seventy-five cents.
2. WILLIAM SCOTT GRAY. *Studies of Elementary-School Reading Through Standardized Tests*. Supplementary Educational Monographs, Vol. 1, No. 1, 1917. Chicago: University of Chicago Press. Pp. viii, 157. \$1.00.
3. M. E. HAGGERTY. *Scales for Reading Vocabulary of Primary Children*. Elementary School Journal, 17: No. 2, October, 1916. 106-115.
4. RICHARD ZEIDLER. *Tests in Silent Reading in the Rural Schools of Santa Clara County, California*. Elementary School Journal, 17: No. 1, September, 1916. 55-62.
5. MELVIN E. HAGGERTY. *The Ability to Read: Its Measurement and Some Factors Conditioning It*. Indiana University Studies, No. 34, January, 1917. Pp. 63. Twenty-five cents.
6. WILLIAM S. GRAY. *The Relation of Silent Reading to Economy in Education*. Sixteenth Yearbook of the National Society for the Study of Education. Part I, 1917. 17-32.
7. ALVA M. RICHARDS AND PERCY E. DAVIDSON. *Correlations of Single Measures of Some Representative Reading Tests*. School and Society, 4: September 2, 1916. 375-377.
8. WILLIAM S. GRAY. *A Coöperative Study of Reading in Eleven Cities of Northern Illinois*. Elementary School Journal, 17: No. 4, December, 1916. 250-265.
9. IRVING KING. *A Comparison of Slow and Rapid Readers*. School and Society, 4: November 25, 1916. 830-834.
10. E. J. LLEWELYN. *Reading in the Mount Vernon, Indiana, City Schools*. Elementary School Journal, 17: No. 2, October, 1916. 123-127.
11. W. L. UHL. *The Use of the Results of Reading Tests as Bases for Planning Remedial Work*. Elementary School Journal, 17: No. 4, December, 1916. 266-275.
12. WILLIAM S. GRAY. *Emphasis on Reading Instruction*. Elementary School Journal, 17: No. 3, November, 1916. 178-186.

The recent activity in the experimental investigation of reading in the schools is evidence that school authorities are becoming more keenly aware of the importance of this subject in education, and more anxious to test the results that are obtained from present methods of instruction. Reading and handwriting have been more carefully investigated by psychologists than any other school subject. The eye movements involved in reading have been recorded by several investigators, but most of the experiments were conducted on adults. Schmidt (1) with a modification of the Dodge photographic apparatus has made an elaborate study of the eye movements of over eighty individuals drawn from the university, high school and elementary school, as far down as the second grade. Eye movements were studied in both oral and silent reading with different kinds of material. Oral reading was found to require 1.6 more pauses per line than silent reading, and the average duration of these pauses was from 20 to 27 per cent. greater. Further, it was found that oral reading requires from 44 to 64 per cent. more perception time than does silent reading. The monograph contains a carefully compiled bibliography of previous investigations of eye movements, and a well digested historical sketch of other experimental work in this field.

While the physiological factors involved in reading are undoubtedly important and call for further study in many particulars, it is the determination of reading ability through standard tests that has aroused the greatest interest in the subject. Dr. Gray's monograph (2) is the most elaborate discussion of tests in reading that has yet been issued. His summary of previous investigations covers 23 pages, and is followed by a carefully annotated bibliography of 48 numbers. This chapter gives a very complete account of the derivation and application of reading tests to the present time. Dr. Gray was the first to devise a test for oral reading, and while the test was described in Judd's *Measuring the Work of the Public Schools* (The Cleveland Survey), this is the first detailed account of the derivation of the test and its validity. The silent reading test is unique in that the selections have been experimentally chosen for the grades for which they are intended; the rate of reading is determined by the time taken to read a standardized portion in the middle of the selection, thus giving a paragraph before and after the significant reading of the test; and the degree of comprehension is determined by a combination of reproduction and answers to questions on the passage. The most interesting and important part of the monograph for educa-

tional psychologists is chapters IV and V, on the validity of the oral and the silent reading tests. Here the author describes in detail the preliminary experimentation in the selection of test material, the determination of the steps of difference in difficulty between the paragraphs, and the validity of the scale as indicated by the agreement between the theoretical and the ascertained values. Chapter VI repeats in somewhat greater detail the report on the Cleveland Survey, and chapter VII discusses such special problems in reading as periods of growth in reading achievement, rates in oral and silent reading, and the relation of growth in oral-reading ability to comprehension of subject-matter read. The study sets a high standard for the Chicago Educational Monographs and must be carefully studied by every experimentalist in education.

In his study of the reading vocabulary of primary (I B) children, Haggerty (3) made use of the minimum vocabulary tests proposed by Jones in the Fourteenth Yearbook of the National Society for the Study of Education. These lists consisted of 118 "phonetic" words and 236 "sight" words, selected on the basis of the frequency with which they occurred in ten standard primers. The lists were given to seven hundred low first-grade children, and on the basis of percentage of correct responses scales were constructed which consist of nine steps for the phonetic words and twelve steps for the sight words. On the basis of these results abbreviated scales were constructed with five words in each step and five or six steps in each scale. These scales would seem to offer very promising material for determining the degree of familiarity with printed words which pupils possess on their entrance to school.

In his study of silent reading in rural schools Zeidler (4) made use of the Starch reading tests. The tests were given to from 100 to 200 pupils in each grade from III to VIII. Twenty-six schools were involved in the test. Instead of giving the selection which Starch indicates for each grade, selection number 3 was given to grades III and IV, number 5, to grades V and VI, and number 7, to grades VII and VIII, while selection number 5 was also given to grade IV and number 7, to grade VI. This overlapping gave a check on the results obtained from each grade by single tests. In the evaluation of the reproduction each element of each selection was weighted in terms of the combined judgments of university faculty men. The results of the tests showed that in rate of reading, the elementary pupils fall somewhat below the standard scores given by

Starch, but are equal to those obtained from pupils of the same grade in the town of San Jose. In reproduction, however, the scores are distinctly lower than those from pupils in town schools. This is the more significant in that a detailed comparison of scores grade by grade reveals a high coefficient of correlation. The larger and better organized schools make a distinctly better showing than the small, one- and two-teacher schools.

The report of Haggerty (5) gives an account of the application of the Thorndike reading tests in twenty Indiana cities. The tests given were the visual vocabulary, preliminary and scale A, and the understanding of sentences, preliminary and scale Alpha, sets a, b, c, and d. The method of scoring is illustrated by the individual tabulation of results from typical classes, and charts present the median scores for each grade from the third to the eighth in each of the eighteen cities. The usual picture of the overlapping of abilities in the different grades, made familiar by the work of Courtis in arithmetic and by Starch in various school subjects, is brought out with great clearness in these results. Whether this overlapping is evidence of "the unsatisfactory character of the grading of children," as the experimentalists charge, is a matter that calls for further investigation. Undoubtedly students are badly graded for reading alone, or for addition alone, or for spelling alone. But with our present school organization it is impossible to have gradings of pupils for each school subject, and no one has yet attempted to obtain a combined measure of the attainments of pupils in all their subjects to determine from the administrative stand-point how well they are graded. This is a task for some enterprising superintendent to undertake. It would be interesting to see what would be the result of grading and promoting pupils of a school system for a period of years strictly on the basis of the combined results of educational tests. On the question of speed versus accuracy the author comes to the negative conclusion that inaccuracy is not a necessary correlative of rapid work nor is slow work a guarantee of correctness. The proper adjustment of speed and accuracy seems to be a highly individual matter. Mere increase in age does not carry with it increase in vocabulary, for in general the youngest children in each class are superior to the oldest. Comparison of the sexes shows a slight but constant superiority in favor of the girls.

The significance of reading tests for practical schoolroom problems is discussed by Gray (6) in his consideration of economy of time.

Substantially all investigations show that silent reading is a more rapid process than oral reading, and the preponderance of evidence inclines to the view that the rapid reader is usually more efficient than the slow reader. It is true that in the beginning reading must be predominantly oral. The rate of both oral and silent reading increases rapidly during the lower grades and tends to reach a maximum in the higher. The comprehension of what is read improves steadily throughout the grades and can be materially increased by training. Tests of speed and quality of silent readings should be made at frequent intervals in order to determine the most urgent instructional needs of the children.

With so many reading tests now in the field a comparative study of the results of these tests on the same pupils would be enlightening both as a basis for a criticism of the tests themselves, and as a step in determining their desirability as measures of reading ability. An initial study of this type has been made by Richards and Davidson (7) on 400 third- and fourth grade California children. The tests used were the Starch reading tests for the third and fifth grades, the Kelly tests for the third, fourth and fifth grades, the original Trabue Completion Test, a vocabulary test patterned after Thorndike's, and a narrative completion test. It will be seen that only the Starch and Kelly tests are properly strict reading tests, although the others may involve abilities upon which effective reading depends. In general the correlations, determined by the Spearman Footrule method, are rather low, ranging from .25 to .42. Interestingly enough, the lowest correlation is that between the Starch and Kelly tests, while the highest is between the Trabue and the Narrative completion tests. The authors are careful to point out that no one knows to what extent any of these tests is a measure of reading ability, but the results reinforce the conviction already expressed by some writers that the Starch and Kelly tests do not measure the same kind of thing. More extensive comparisons of reading tests are greatly to be desired.

Another coöperative study of reading was carried out under Gray's supervision (8) by a committee of the Illinois State Teachers Association. The Gray tests for both oral and silent reading were used, but the scores for oral reading were based entirely upon rate and errors, with no attempt at reproduction. A comparison of the average scores with those obtained from other cities shows that they are distinctly low in both oral and silent reading. Another feature of the

scores is the wide variation shown by classes of the same grade. Some third-year classes, for example, are fully two years in advance of others. This seems to be due partly to the success of the teacher in inspiring the pupils with a zest for reading, and partly to the amount of attention that is paid to securing a proper balance between rate and accuracy. Teachers need to have objective standards of attainment defined for them in each grade, and should be urged to make frequent critical studies of the results of their teaching. There should be initial tests at the beginning of each term, comparison of the results with standards attained in other communities, and tests of progress at intervals throughout the term. The standing of the Illinois schools in silent reading was distinctly lower than in oral reading. A greater quantity of reading with emphasis on thought comprehension is recommended for the second and third grades, with increasing practice in silent reading.

Gray inclines to the view that rapid readers get the most out of what they read. Shall we, then, try to develop as great speed as possible in each pupil? King (9) investigated the relation of speed and accuracy in 94 college students. These were divided into a fast and a slow group by requesting each alternate student to read slowly and carefully, while the others were to read rapidly and carefully. In the ten minutes allowed the "slow" group were requested not to read beyond a certain point. A clock was before them, and if they found themselves reading too fast they were to slow down. The "fast" group were to read twice as far, and to speed up if they found themselves getting behind. At the end of the ten minutes it was found that each group of students had read approximately what was expected of them.

Both groups were then tested for comprehension of what they had read. This test consisted in replies to mimeographed questions on the passage. It was found that the "fast" readers replied with an average accuracy of 44.5 per cent., the "slow" readers with 53.3 per cent. Analyzing the results a little more closely and calling those good who got more than fifty per cent. correct in each group, and those poor that got less than fifty per cent. correct, it was found that twenty-one good "slow" readers averaged 65 per cent., and seventeen good "fast" readers averaged 61.5 per cent. Of the poor reproducers those in the "slow" group averaged 43.9 per cent., and those in the "fast" group averaged 35 per cent. From these figures the author concludes that the slow readers are superior to the rapid readers in the amount that they get from the reading.

It is obvious that this test gives little information as to the relative merits of *naturally* slow or fast readers. Inquiry showed that there were naturally slow and fast readers in both groups. As a result the rapid readers in the "slow" group would have opportunity to re-read much of the passage and thus partly memorize it. This would tend to increase the reproduction score of the "slow" group. On the other hand, the slow readers in the "fast" group would find themselves quite out of their element, and would be obliged to skim over the lines so rapidly that they would be unable to give any intelligent account of the passage read. This, therefore, would tend to pull the score of the "fast" group down. In view of the fact that the "fast" group read twice as much in the given time as the "slow" group the surprising thing is not that the "slow" group had a better accuracy score, but rather that the results were not farther apart than the figures indicate.

In a second test the class was divided into naturally fast and slow readers on the basis of a preliminary experiment. All were started reading at the same time and were stopped after five or six of the fastest readers had finished. Wide differences in rate were found, the extremes having the ratio of 5 to 12. All were tested with questions on the passage. The fastest 25 per cent. of the group showed an accuracy of 50.2 per cent., while the slowest 25 per cent. had an accuracy of 48 per cent. The middle fifty per cent. had an accuracy of only 46.5 per cent., and when the entire class was ranked for speed and accuracy the Pearson coefficient of correlation was $r = -.07$. While the author seems to think that the results are in favor of the slow readers, a more careful consideration of the entire experiment leads rather to the conclusion that the advantage is strikingly with the group of naturally fast readers. Whether the rate of reading could be increased with practice without any reduction in efficiency is a question on which the experiment throws no light.

Llewelyn (10) concluded from general observation (no tests were used) that the poorest reading was to be found in the fourth, fifth and sixth grades. A conscious effort was made to correct this by giving more attention to silent reading and less to oral reading in these grades. What oral reading was done was motivated by allowing the child to read to the class something in which he thought the class would be interested. Much of the time of the reading period was devoted to suggestions about preparing the lesson, and to a discussion of the lesson already prepared. The teachers also encouraged the

pupils to read extensively in books procured from the public library. Four months of this procedure resulted in a great increase of interest in reading by the pupils, a marked increase in the circulation of library books, a growth of interest on the part of teachers in teaching the subject, and more careful and thorough preparation by teachers for the reading periods. While the oral reading showed no improvement, the intellectual tone was greatly benefited.

Uhl (11) made use of the Kelly reading tests with the pupils of grades III-VIII to select those who needed especial attention in reading. The number of pupils in each grade ranged from 14 to 25. To those who stood especially low in each grade, the Gray oral reading test was given, and to some of these who pronounced fairly well but did not seem to comprehend what they were reading, the Gray silent reading test was given. It was found that several bright pupils made low scores on the Kelly tests because of chance conditions. The author makes an extended diagnosis of typical cases of individual defect. Some made low scores on account of extreme care, other on account of extreme carelessness. On the basis of this diagnosis the pupils were given an intensive drill focussed especially upon their individual defects. At the end of the term the tests were given again. The most of those drilled showed material gains. A detailed analysis of these gains leads the author to think that the Kelly tests are true measures of reading ability and not tests of general intelligence as claimed by some.

Educational tests are significant only in so far as they modify or throw light upon the processes of instruction. Gray (12) has made a comparison of the scores from his reading tests in Cleveland and St. Louis to bring out differences in emphasis on various phases of reading instruction in the two cities. The results show a constant and uniform superiority in oral reading in every grade of the St. Louis schools. A closer analysis shows that Cleveland emphasizes speedy association of pronounced word with printed symbol. In St. Louis, on the other hand, greater deliberateness and certainty are striven for, and are attained to such a degree as to put the pupils from one eighth to one-half year ahead of the corresponding grades in Cleveland. In silent reading, the rate is for the most part in favor of Cleveland, but in accuracy St. Louis is markedly superior in every grade.

It will be readily seen from these recent studies of the measurement of reading ability what a valuable instrument of precision is here afforded the school superintendent, principal or teacher, for deter-

mining the status of the attainments of pupils and the amount of improvement made as the result of a given type of training. As yet we are only at the beginning of the derivation and utilization of such tests. We do not yet know the degree of reliability of single tests, nor have there been sufficiently extensive comparative studies of the various tests to enable us to determine which test affords the better indication of reading ability. With the many workers who are now turning their attention to this subject, experimental studies will multiply rapidly and in a few years the teaching of reading will be placed upon a scientific basis scarcely dreamed of a decade ago.

J. C. B.

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EDITORIALS

One outcome of recent school surveys is the added attention to instruction and attainment in elementary school subjects. Not the least important of these is reading. Investigations have been carried on to determine the points of strength and weakness in the existing methods of instruction, and the legitimacy of the effort expended in relation to the product. Questions arise of whether the objective point in teaching reading should not be varied from grade to grade; whether teaching of reading as it has been rather uniformly carried on in the grades has of itself reared any barrier to the ends sought; whether *what* one reads rather than *how* one reads is not the important element; and wherein lies the chief value of reading that it shall absorb so large a part of the time spent in school. These problems might well be considered by high school teachers whose tendency has been to over-emphasize the analysis of the classics rather than to stress reading for purposes of gathering ideas and using them for revelations in other fields.

Reading in the public schools has been in the past largely a matter of securing effective oral expression, and while schools do not aspire

to the results attained by teachers of expression, formerly called "elocution," yet all the gymnastics attendant upon the mechanics of expression have had their share of attention. Vocal accompaniment to the getting and reproducing of thought has often been the criterion by which advance in reading has been estimated. Again, the mechanics of reading has received attention on the side of quick association of symbol and pronunciation to the exclusion of comprehension. To realize the efficiency of reading in relation to other subjects one must establish anew the value of reading in intellectual attainment and practical achievement. If it is conceded that efficient grasp of content is the chief function of reading, one may then shift the emphasis from correct and fluent vocalizing to mastery of the ideas expressed.

Efficiency in grasp of content must include rate of reading as well, since extensiveness can not be unduly sacrificed to intensiveness. Comprehension and retentiveness are included in this also. What do investigations show to be necessary for success in acquiring ability to read?

Briefly, it has been found that attention must be given to habits of visualizing the printed page, to increasing the span of attention, to the exercise of alertness in mastery of the content, and to individual differences. Awkward and wasteful habits which hinder rapid reading must be counteracted. The knowledge that the articulation of the child in the first grade is quite comparable to that which he will have in the eighth grade, or as an adult, might justify the abandonment of the attempts throughout the school to raise the achievement in that direction. Increase in rate is slow after the fifth grade; comprehension regularly increases from lower to upper grades. Opportunities for development in mechanics are possibly the greatest in grades three and four. Tests tend to stimulate achievement in speed rather than comprehension. Silent reading, with which little has been done, has not yet had its technique mastered by teachers, although they have realized the validity of its claims.

Such findings and recommendations as are here suggested are carefully elaborated in the Cleveland Survey by Judd and Bobbitt. As Dr. Judd remarks in commenting on the situation in Cleveland, since "American schools are chiefly reading schools," different from European in the amount and character of oral instruction, it is well worth while to know what constructive effort can be expended to secure the greatest good at all points along the line from grade to grade.

G. M. W.

NOTES AND NEWS

The British Medical Journal reports that an investigation on the annual growth of the brain on the living subject between the ages of six and twenty-one years has recently been inaugurated by Professor Berry of Victoria University, Australia. The research has entailed the examination of 1700 boys and girls. The director of education has been sufficiently interested in the preliminary results submitted to him to promise the coöperation of his department for the further prosecution of the work, and arrangements are now completed for a considerable extension of the investigation during the current academic year. As Mr. S. D. Porteus, of the Bell Street State School for mentally deficient children, has taken an active part in the investigation there is, for the first time, the necessary combination of the physical and mental experts.—*School and Society*.

The Edinburgh University Court has agreed to approve the draft regulation submitted for the degree of bachelor of education and for the university diploma in education.—*School and Society*.

Announcement is made of the publication of *Psychobiology*, a bi-monthly journal devoted to the field common to psychology and the biological sciences. The new journal is edited by Professor Knight Dunlap, of Johns Hopkins University, in association with John J. Abel, Johns Hopkins Medical School, Walter B. Cannon, Harvard Medical School, Raymond Dodge, Wesleyan University, Shepherd I. Franz, Government Hospital for the Insane, Herbert S. Jennings, Johns Hopkins University, and George H. Parker, Harvard University, and is published by Williams and Wilkins Company, Baltimore.

The San Francisco Polyclinic has opened a mental hygiene clinic under the direction of Dr. Lillian J. Martin. Among the aims of the clinic we note elimination of injurious mental and physical habits; increase of individual power in observation, attention, concentration, memory and will; aid to mothers and teachers in educating and managing, not alone their nervous children, but also those who are healthy, through applying the results of recent investigations along the lines of heredity and mental diseases; assistance to students and others in adjusting themselves to their work; and aid in the selection or change of a vocation.

At the April meeting of the New York Branch of the American Psychological Association the following papers were presented: "The Speed and Accuracy of Motor Adjustment," by J. J. B. Morgan; "Student Ratings of One Another with Reference to Prospective

Teaching Ability," by G. C. Myers; "Some Problems in Dream Interpretation," by L. H. Horton; "The Law of Effect in Relation to Neuroses," by T. H. Ames; "Effects of Alcohol on Animal Behavior," by Halsey Bogg.

Among the visiting members of the faculty at the summer session of Washington University will be Daniel E. Phillips, head of the department of psychology and education at the University of Denver, and Fred C. Ayer, professor of education in the University of Oregon.

Dr. Francis Wayland Shepardson, associate professor of American history in the University of Chicago, has been appointed by Governor Lowden, of Illinois, to be director of the department of registration and education, one of the nine departments under which the administrative work of the state has been grouped. On the educational side the department covers the work of the five normal schools, the state geological survey, the state museum of natural history, and other scientific undertakings under state auspices.

Professor William C. Bagley, director of the school of education, University of Illinois, has accepted an appointment as professor of education in Teachers College, Columbia University. Professor Bagley will organize a new department of education in connection with the work of normal schools and teachers' training classes.

Professor W. W. Charters, dean of the school of education of the University of Missouri, has accepted the position of professor of educational administration at the University of Illinois.

Dr. Truman Lee Kelley, adjunct professor of educational psychology at the University of Texas, has been appointed assistant professor of education at Teachers College, Columbia University. Dr. Kelley's work will be concerned with statistical and psychological problems in the field of secondary education.

Dr. A. H. Sutherland, of Yale University, has been appointed psychologist in the public schools of Los Angeles, California.

Dr. George R. Wells, associate professor of psychology in Oberlin College, has been appointed to a new professorship in psychology at the Ohio Wesleyan University.

Dr. C. E. Ferree, of Bryn Mawr College, has been promoted to a full professorship of experimental psychology at that institution.

Dr. Arnold L. Gesell, professor of child hygiene at Yale University, who has been absent for the past two years on account of illness, will resume his work next fall.

Dr. William Scott Gray and Dr. Harold Ordway Rugg have been promoted to assistant professorships in the department of education at the University of Chicago. Dr. Gray is dean of the college of education.

Dr. Raymond Dodge, professor of psychology at Wesleyan University, has been appointed to the Ernest Kempton Adams research fellowship at Columbia University.—*Science*.

Dr. Edward Herbert Cameron, assistant professor of education at Yale University, will be a member of the summer faculty at the University of Chicago.

Dr. F. W. Ballou, recently elected associate superintendent of schools in Boston, will give courses in educational measurements at the Harvard University summer school.

Dr. Louis W. Rapeer, professor of education at the Pennsylvania State College, has been appointed dean of the University of Porto Rico.

Dr. Roswell P. Angier has been promoted to a full professorship in psychology at Yale University.

Professor Edward L. Thorndike, of Teachers College, Columbia University, has been elected member of the National Academy of Sciences.

Dr. Robert M. Yerkes, assistant professor of psychology in Harvard University and president of the American Psychological Association, has accepted an appointment as professor of psychology and director of the psychological laboratory at the University of Minnesota.

Professor Ernest C. Moore, of Harvard University, has been elected president of the Los Angeles State Normal School, with the understanding that he is to transform the institution into a teachers college.

Dr. J. E. W. Wallin, of the educational clinic connected with the St. Louis schools, will offer courses in clinical psychology and on subnormal children in the State University of Iowa during the summer session.—*School and Society*.

Dr. Charles R. Mann, professor of physics in the University of Chicago, who for the past three years has been on leave of absence to make a report on engineering education for the Carnegie Foundation, has been called to the Massachusetts Institute of Technology to be chairman of a committee of the faculty charged with the special duty of considering ways and means of improving methods of instruction.—*School and Society*.

PUBLICATIONS RECEIVED

EDITH ABBOTT AND SOPHONISBA P. BRECKINRIDGE. *Truancy and Non-Attendance in the Chicago Schools. A Study of the Social Aspects of the Compulsory Education and Child Labor Legislation of Illinois.* Chicago: The University of Chicago Press, 1917. Pp. xiii, 472. \$2.00.

This is an interesting study of compulsory school attendance from a broad social point of view. Part I discusses the legal aspects of compulsory education and outlines the history of the movement for compulsory school attendance in the State of Illinois from 1818 to 1916. It is interesting to note that in the past two decades the enforcement of the compulsory education laws and the passage of child labor laws have gone hand in hand. Part II deals with present conditions and methods of treatment. There is, first, a study of truancy and non-attendance on the basis of the records of nine selected schools. There are, further, chapters on the relation of truancy and non-attendance to the transfer system, to the mental and physical defects of children, and to dependency and delinquency. The functions of the parental schools, the municipal court, the school census and the visiting teacher are considered as agencies for the enforcement of the school law. A strong plea is made for compulsory education between the ages of fourteen and sixteen. The authors urge that the issuance of working papers be taken from local school superintendents and given over to the state educational authorities; that not only should there be a minimum age of sixteen but a minimum of physical and educational development; that a system of compulsory day continuation schools be developed and that attendance upon these be required of working children under eighteen years of age for a certain number of hours per week.

GEORGE HERBERT BETTS. *The Mind and Its Education.* Revised and Enlarged Edition. New York: D. Appleton and Company, 1916. Pp. xvi, 311.

It is a source of gratification to the author that this popular elementary treatise on psychology has had such a favorable reception. In the revised edition the topics of sensation and perception have received more extensive treatment, a new chapter on association has been added, and several chapters have been subdivided into numbered sections. The book keeps close to the traditional concepts of psychology and shows no influence of the recent activity in mental tests or of the trend toward behaviorism.

BROTHER CHRYSOSTOM. *Development of Personality. A Phase of the Philosophy of Education.* Philadelphia: John Joseph McVey, 1916. Pp. xxv, 379. \$1.25.

As one might imagine, this is a plea for religious education, especially an education imbued with the ideals of the Catholic faith. It

is very interesting to see the biological psychology of Baldwin, the behaviorism of Watson, and the heredity theories of the eugenists calmly referred back to mediaeval philosophy. The author knows his modern biology and psychology. He is familiar with James, Titchener, Woodworth, Colvin, Dewey and even so recent a writer as Ellwood; and at the same time shows great skill in manipulating these arguments and using them to support his fundamental thesis, which is the need of mankind for training in the doctrines of the Roman Catholic Church:

TH. FLOURNOY. *The Philosophy of William James*. Authorized translation from the French by Edwin B. Holt and William James, Jr. New York: Henry Holt and Company, 1917. Pp. ix, 246. \$1.30.

An interesting and sympathetic account of James' early life, his rejection of monism, and his attitude toward pragmatism, radical empiricism, pluralism, theism and the will to believe. James was primarily a psychologist and all of his philosophical theories were founded upon his psychology. In the opinion of the author he was probably the greatest psychologist that has ever lived, and we cannot hope soon to see his equal. The present book will undoubtedly gain a wider circle of friends for this psychological view of the universe.

HENRY FRANK. *Psychic Phenomena, Science and Immortality*. Second Edition. Boston: Sherman, French and Company, 1916. Pp. 556. \$2.50.

The author of this book reveals an extensive familiarity with the trend of theory in modern physics and with the biology and psychology of a generation ago, and shows no little acumen in using these scientific data to support his view of the reality of spiritistic materialization. Such chapter headings as "The Seat of the Sub-conscious Mind," "Super-physical Senses," "Psychic Phenomena and Soul Substance," "Scientific Discovery of the Soul-body," "The Subtle Seat of Human Intelligence," and the like, point the way in which the author has gone, and are quite sufficient to the initiated to indicate the type of argument which one finds in the book. The scientifically minded individual can only regret this use of good knowledge in a bad cause.

WILLIAM SCOTT GRAY. *Studies of Elementary School Reading Through Standardized Tests*. Supplementary Educational Monographs, No. 1. Chicago: University of Chicago Press, 1917. Pp. viii, 157. \$1.00.

This monograph gives us a detailed description and analysis of the tests of silent and oral reading used in the Cleveland Survey. There is a fairly extensive summary of previous investigations in reading, with a bibliography of forty-eight numbers; a description of the oral reading tests, with directions for use and standards for scoring; three specimens for use in silent reading tests, with questions

on each and directions for scoring; and a detailed discussion of the validity of both oral and silent reading tests on the basis of several thousand scores. A chapter is devoted to an extended account of the results of Cleveland Survey, and there is a final chapter on special problems in reading, including (1) periods of growth in reading achievement; (2) rates in oral and in silent reading; (3) relation of growth in oral reading ability to comprehension of subject matter read. The monograph is a valuable addition to the experimental literature on reading.

W. A. JESSUP AND L. D. COFFMAN. *The Supervision of Arithmetic*. New York: The Macmillan Company, 1916. Pp. 225. \$1.10.

This is not a handbook for the teaching of arithmetic, but presents the results of some investigations of problems in the supervision of the subject. The authors discuss such topics as the subject matter of arithmetic and its distribution by grades, time allotment, dominance in methods of teaching, the sequence of the multiplication tables, oral work, drill, problems related to business life, and the results of special tests and investigations. The book is an excellent summary of recent thought on arithmetic in the schools, and will be a great help to superintendents and supervisors.

PAUL KLAPPER. *The Teaching of Arithmetic. A Manual for Teachers*. New York: D. Appleton and Company, 1916. Pp. vii, 387. \$1.45.

The author states in the preface that the aim of this book is to evolve a plan of teaching which is based on an approved psychology of number, which incorporates the lessons of contemporary research in methodology, and which has stood the final test of experience. In discussing the values of arithmetic the author frankly accepts the findings of experimental psychology and education as to the limited nature of the transfer of training, and therefore lays little emphasis upon the disciplinary value of the subject. Of the other values the cultural is largely a matter of tradition, the preparatory value applies chiefly to those who go on to higher work in mathematics, and the chief consideration left is its pleasure value. This, of course, has a profound effect upon the selection of subject matter in the course of study of arithmetic, and upon the methods employed in teaching the subject. If its chief value is satisfaction, then every effort should be made to raise this satisfaction to its highest point, and to eliminate as far as possible any disagreeable features that have characterized its presentation in the past. There are good diagrams comparing courses of study in arithmetic, a valuable discussion of general principles of teaching the subject, chapters on the organization of a recitation in arithmetic, devices for teaching the fundamental operations, common and decimal fractions, percentage and denominate numbers, graphs and the elements of statistics, and a final chapter on the Courtis Tests in Arithmetic. In an appendix the author also presents the Rice and the Stone tests.

NORBERT J. MELVILLE. *Standard Method of Testing Juvenile Mentality by the Binet-Simon Scale*. Philadelphia: J. B. Lippincott Company, 1917. Pp. xi, 140.

The author states in his preface, "Hitherto no Binet manual has appeared which embodies a uniform method of dealing with such questions as the following: With what tests should the examiner begin? Which of two alternative questions should be first employed in a given case? Under what conditions may a test be repeated? By what precise standards shall we decide whether responses in such tests as the definitions should be credited to age six or age nine?" This does not mean that the manuals of Goddard, Huey, Kuhlmann, Wallin and Terman are ignored, for the first thirty pages of the monograph are devoted chiefly to a critical discussion of the theory and practice of mental testing. The form of the scale used is the Binet revision of 1911. The chief characteristics of the author's "Uniform Method" are the grouping together of those tests which have proven most significant for the diagnosis of mental deficiency in one group, those which stand next in diagnostic value in a second group, and so on for six distinct groups of tests. Further those tests which involve similar material or methods are arranged in the same series so that they will be given in sequence. There are four pages of references to recent literature on Binet testing, samples of test record sheets, directions to examiners, and general rules for procedure. Part II contains the detailed directions for applying the individual tests, with notes indicating modifications found in various adaptations. These directions are conveniently thumb-indexed so that one can turn directly to the series of tests desired. Casual inspection leads one to think that the manual will be a very convenient guide for those who desire to use the original Binet 1911 revision.

J. C. MUERMAN. *Minimum School Term Regulations*. Bulletin, 1916, No. 42. Washington: Bureau of Education, 1916. Pp. 18. Five cents.

The general regulations regarding minimum school term are first reported by states and are again presented in compact tabular form.

JOSEPH C. PARK AND CHARLES L. HARLAN. *Some Facts Concerning Manual Arts and Home-making Subjects in One Hundred Fifty-six Cities*. Bulletin, 1916, No. 32. Washington: Bureau of Education, 1916. Pp. 25. Five cents.

The dominant aim is prevocational in character, and the attempt is made to give the pupil a broad idea of the use of tools, material and processes, rather than to develop a high degree of technical skill.

RUDOLF PINTNER AND DONALD G. PATERSON. *The Ability of Deaf and Hearing Children to Follow Printed Directions*. Reprinted from the Pedagogical Seminary, 23: 1916. 477-497.

The authors used the Woodworth and Wells easy directions tests and found that the average deaf child's ability is about equal to that of the average hearing child between the ages of six and eight.

Practice Teaching for Prospective Secondary Teachers. Educational Monographs, the Society of College Teachers of Education, No. 7. Cedar Rapids, Iowa: The Torch Press, 1916. Pp. 74. Twenty-five cents.

This monograph contains a report on the *Administrative Features of Practice Teaching for Secondary Teachers*, by A. R. Mead; *Interrelations of Departments or Schools of Education with Academic Departments for Supervision of Practice Teaching and Special Method Courses*, by W. G. Chambers; *The Results of Practice Teaching for Secondary Teachers as Shown by Opinions of Superintendents*, by H. G. Childs; *Brief Descriptions of Organized Systems of Practice Teaching*; Recommendations of the Committee; and a bibliography of six pages.

JANET R. RANKIN. *Wisconsin's Overage Children.* Madison, Wis.: State Department of Education, 1916. Pp. 12.

Approximately fifty-three per cent. of the children of the Wisconsin schools were found to be overage. Remedies suggested for this condition are good instruction, good attendance, good discipline, summer or vacation schools, good supervision, flexible promotions, coöperation between the home and the school, and the revision of the course of study.

WILHELM HEINRICH RIEHL. *Burg Neideck.* Edited with notes by Garrett W. Thompson. Cincinnati: American Book Company, 1916. Pp. 224.

This is a very convenient and attractive edition of a story that is full of charm and interest for high school students.

EDWARD RUTLEDGE ROBBINS. *New Solid Geometry.* Cincinnati: American Book Company, 1916. Pp. xviii, 261-458.

As will be seen from the paging, this book is a continuation of the author's "New Plane Geometry." The figures are splendidly drawn and the book throughout shows the highest grade of workmanship.

State Higher Educational Institutions of Iowa. Bulletin 1916, No. 19. Washington: Bureau of Education, 1916. Pp. 223. Twenty-five cents.

This is the report of the survey of the work done in the three institutions for higher education in Iowa: The Iowa State University, The Iowa State College of Agriculture and Mechanic Arts and The Iowa State Teachers College. Recommendations are made to avoid duplication and to increase the efficiency of each institution.

CLIFF W. STONE. *Standardized Reasoning Tests in Arithmetic and How to Utilize Them.* New York: Teachers College, Columbia University, 1916. Pp. 24. Cloth, eighty cents; paper, fifty-five cents.

This is a reprint of the essential features of the author's "Arithmetical Abilities," the edition of which is now exhausted. The

author presents the original tests, directions for giving and scoring them, the graphic representation of the scores, and tentative standards.

GEORGE DRAYTON STRAYER AND NAOMI NORSWORTHY. *How to Teach*. New York: The Macmillan Company, 1917. Pp. vii, 297. \$1.30.

"The art of teaching is based primarily upon the science of psychology. In this book the authors have sought to make clear the principles of psychology which are involved in teaching, and to show definitely their application in the work of the classroom." The titles of the chapters are The Work of the Teacher; Original Nature; Attention and Interest in Teaching; The Formation of Habits; How to Memorize; The Teacher's Use of the Imagination; How Thinking May be Stimulated; Appreciation; The Meaning of Play; The Significance of Individual Differences; The Development of Moral-Social Conduct; Transfer of Training; Types of Classroom Exercises; How to Study; and Measuring the Achievements of Children. In the discussion of formal discipline the position is taken that the amount of transfer depends chiefly upon the closeness of the bonds of identity between the two situations. The final chapter on measurement contains a discussion of the Woody Arithmetic Scales, the Thorndike Handwriting Scale, the Hillegas Composition Scale and the Trabue Language Scale. The book will be of very great value in introducing the young teacher to the results of recent scientific studies in education.

EDWARD K. STRONG, JR. *Effects of Hookworm Disease on the Mental and Physical Development of Children*. International Health Commission. Publication No. 3. New York: The Rockefeller Foundation, 1916. Pp. 121.

The problem of this investigation was to determine the difference among children not infected with hookworm, those infected and later cured, those infected and treated but not completely cured, and those infected but not treated. The children were measured and tested for height, weight, grip, lung capacity and tapping, and were also given the following mental tests: Opposites, Calculation, Logical Memory, Memory Span, Handwriting, Formboard and the Binet-Simon Tests. The author concludes that hookworm disease interferes decidedly with both physical and mental development. The longer the child has the disease the more he will lose mentally, and the less rapid will be his mental development after he has been treated.

GLEN LEVIN SWIGGETT. *Commercial Education*. Bulletin, 1916, No. 25. Washington: Bureau of Education, 1916. Pp. 96. Ten cents.

This is a report on the papers and addresses presented before the commercial sub-section of the second Pan-American scientific congress.

WINTHROP TALBOT. *Adult Illiteracy*. Bulletin, 1916, No. 35. Washington: Bureau of Education, 1916. Pp. 90. Fifteen cents.

Tables and graphs are presented to show the percentage of illiteracy in the various states by age groups, sex and nationality, and examples are cited to show the effort that is being made to combat and overcome illiteracy in this country.

LEWIS M. Terman and H. E. Knollin. *Some Problems Relating to the Detection of Borderline Cases of Mental Deficiency*. Reprinted from Journal of Psycho-Asthenics, 20, Nos. 1 and 2, September and December, 1915. Pp. 15.

The authors find that the earlier revisions of the Binet Scale are unfair to the dull-normal and borderline adults, causing these to test much too low. The result is an overestimation of the amount of feeble-mindedness among criminals, delinquents, etc. The more retarded the child is the stronger is the presumption that he is not as retarded as he ought to be. The judgment of the teacher upon the child's mental deficiency was found to be quite unreliable, while the results of the tests of intelligence were fully confirmed by subsequent school history.

AUGUSTUS O. THOMAS. *Rural Arithmetic*. Cincinnati: The American Book Company, 1916. Pp. 288.

This text is designed for classes in the upper elementary grades and in the high schools. Instead of the usual arithmetical rubrics we have such headings as tests for accuracy and speed; parcel post; land measurements; labor, machinery, and crops; feeding problems; farm records and accounts; light, fuel, and water; time and travel; building problems; general business problems; and miscellaneous applications.

University Training for Public Service. Bulletin, 1916, No. 30. Washington: Bureau of Education, 1916. Pp. 94. Fifteen cents.

This is a report of the 1915 meeting of the Association of Urban Universities, and contains papers on the need for coöperation, on methods of training for public service, and on results of coöperative training.

HOWARD C. WARREN. *Mental Association from Plato to Hume*. Reprinted from the Psychological Review, 23: 1916, No. 3. 208-230.

Part of a forthcoming volume on the history of associationism.

FREDERIC LYMAN WELLS. *Mental Regression: Its Conception and Types*. Reprinted from the Psychiatric Bulletin, October, 1916. Pp. 48.

Regression takes place when fundamental trends of the organism are replaced by trends less fundamental. As fundamental the author

considers the sexual-parental trends, the trends for obtaining food, those for protection against enemies, and the social trends. The article cites many instances of such regression, particularly in the sexual trend.

A. S. WHITNEY. *Education at the University of Michigan: History, Present Status, and Pressing Needs*. University of Michigan. June 1916. Pp. 20.

The most pressing needs are a training or laboratory school, and a broader organization as a college of education.

J. HAROLD WILLIAMS. *The Whittier Scale for Grading Home Conditions*. Whittier State School, Department of Research, Bulletin No. 3, 1916. Pp. 14.

The author presents a score card for the measurement of home conditions. The scale is arranged in six steps from 0 to 5 points on the topics: I. Necessities. II. Neatness. III. Size. IV. Parental Conditions. V. Parental Supervision. The scale is applied to grading fifty homes of non-delinquent children and one hundred twenty homes of delinquent boys at the state school.

J. HAROLD WILLIAMS. *Reorganizing a County System of Rural Schools*. Bulletin, 1916, No. 16. Washington: Bureau of Education, 1916. Pp. 50. Ten cents.

The survey includes first the geographical, economic, industrial and social conditions of the county, second, a survey of the present school system, the course of study and the teachers, and third, the discussion of a proposed educational reorganization.

LEON O. WISWELL. *How to Use Reference Books*. Cincinnati: The American Book Company, 1916. Pp. 162.

This includes training on how to use the library, on the use of the dictionary and the encyclopedia, reference books in particular subjects, and a discussion of library organization and equipment.

ERNEST C. WITHAM. *School Report of the Town of Southington, Connecticut*. 1916. Pp. 55.

This report contains records of the standing of the pupils in the Courtis Arithmetic Tests and the Ayres Spelling Scale.

J. H. WORMAN. *New First Spanish Book*. Cincinnati: American Book Company, 1916. Pp. 127.

This introduction to Spanish is constructed on the natural or direct method and is designed for schools or self instruction. There are pictures of familiar objects, and questions and answers on these pictures.

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SOME CAUSES OF MISSPELLINGS

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INTRODUCTION

For a considerable number of years, systematic efforts have been made to find out why school children are not able to show better results in spelling. This has been brought about in large measure, by the criticism of business men that children, graduates of the public schools, fail to spell the simplest words. This criticism, however, has been very general in its nature. The critics do not state whether all the children fail in a few words, or whether each individual finds a small number of words that are difficult for him to spell, or whether all the children fail in nearly all the words used in their written vocabulary. Regardless of how general the criticism has been, it has aroused educators to a sense of their responsibility, which in turn has resulted in a much closer study of the problems involved.

One of the problems involved in the study of the spelling question is the determination of the causes of various misspellings. In order to find an answer to this question, fifty words were selected from the Boston Minimum List¹ in the following manner. All of the words in the minimum lists of grade I to grade VII inclusive were dictated to a class of forty-two children in grade VIII in one of the Boston schools. These words were corrected and a distribution made according to the number of times they were misspelled. As a result of this distribution, the seventy-five percentile point was found. The words misspelled more times than the seventy-five percentile error were then selected and placed in forty-nine groups according to the number of times they were misspelled. After a conference with a number of interested persons, one word was selected from

¹ *Provisional Minimum and Supplementary Lists of Spelling Words for Pupils in Grades I to VIII.* School Document No. 8, 1914. Boston Public Schools.

each group with one exception. "Formally" in the grade VII list, and misspelled twenty-nine times, was not included because it was thought that it did not enter into the written vocabulary of the pupils sufficiently to be a fair test of eighth grade children in their spelling work. To complete a list of fifty words, "busy" and "does" were selected from the second grade list. "All right" and "used to," although not properly words, were included because it was desirable to find the results of spelling such phrases, as they had been indicated by the Boston teachers as troublesome. It may be that learning to spell certain phrases is just as important as learning to spell certain words.

Each of these fifty words was then put into a sentence which would illustrate its meaning and the word to be dictated underlined. The sentences showing the underlined words used in giving the test follow:

1. is *superintendent* of schools.
2. There is a *mortgage* of five hundred dollars on the house.
3. He asked for the *privilege* of going home at recess.
4. The car tracks are *parallel*.
5. The boy was *mischievous*.
6. Something should be done to prevent the frequent *occurrence* of fires.
7. We tell the day of the month by the *calendar*.
8. The *mosquito* is found in damp places.
9. It was *necessary* for me to be home by seven o'clock.
10. The teacher *referred* to yesterday's lesson.
11. The mother will *knead* her bread with her hands.
12. Henry read well, *especially* when the principal came in.
13. The boy rode a *bicycle*.
14. He stood *fortieth* in his class.
15. He did his work *thoroughly*.
16. You may *separate* the good papers from the poor ones.
17. The *twelfth* boy may stand.
18. The *plateau* is a high plain.
19. In a fraction, the number below the line is the *denominator*.
20. His examples are *all right*.
21. Some boys *misspell* their words.
22. Add the first *column* of figures.
23. There is a *bureau* in the bedroom.
24. The doctor has gone to see a *patient*.
25. The potato is a *vegetable*.
26. The boy had a *handkerchief* in his pocket.
27. The answer in division is called the *quotient*.
28. Ten from one hundred leaves *ninety*.
29. The man went to his *business* early in the morning.
30. The boy is *dining* in the large room.
31. Boston is the capital of *Massachusetts*.
32. The boy will *receive* fifty cents for his work.
33. The river formed the *boundary* line between the two states.
34. He *usually* does his work well.
35. Mr. Jones bought a dress for his *niece*.
36. He *used* to do his work well.
37. Every girl should be a good *daughter*.

38. The class is not *quite* ready.
39. Washington's birthday comes in *February*.
40. There is no school on *Saturday*.
41. Every one should be *busy*.
42. There is milk in the *pitcher*.
43. The man *chopped* wood.
44. People *laughed* at his funny actions.
45. It is (not) a *pleasant* day.
46. School begins in the *autumn*.
47. The sun is *shining*.
48. He *doesn't* know his lesson.
49. The boy *does* not like to sell papers.
50. It is very *quiet* in the room.

SELECTION OF CHILDREN

Through the courtesy of the superintendents of three towns near Boston, the test was given to 993 pupils of the ninth grade. Each teacher gave the test according to the following directions:

Directions for Giving the Spelling Test

The sheet on which the pupil writes his words should be headed with the following information:

Name
Sex
Grade

School
Age at last birthday
Room

Pronouncing the words—

First, pronounce *once* the word in the sentence which is underlined. Then read the sentence aloud. Do not pronounce the word after reading. Allow plenty of time for writing the word. The sentences should be read in order, beginning with the first. Write on both sides of the paper.

Caution—

Each word should be pronounced naturally and distinctly by the teacher. Enunciate clearly, but not so as to suggest the spelling.

COLLECTION AND CORRECTION OF PAPERS

Upon the completion of the test, the papers were collected and sent to the office of the superintendent, from which place the bundle for the entire town was obtained. There was no objection to the teacher's correcting the words and giving the result to the class if she wished to. Whether this was done, or not, all the papers were corrected by the author. One of the superintendents had the teachers correct the words and send the results to his office. Tables were then made based on these returns. It is interesting to note that a review of the papers added approximately 16% to the errors in those schools.

BASIS OF MARKING WORDS

A word was marked wrong if it was spelled wrong, or if the first letter was wrongly capitalized. That is, a word was marked wrong if it began with a capital letter when it should have been

a small letter, or if it began with a small letter when it should have been a capital. If there was any question in regard to the marking of a word the advantage was always given to the pupil.

RESULTS OF THE TEST

Causes of Misspellings

In a sense, spelling more than any other subject, may be said to be physiological. It has been said that any child that can see correctly can spell. That is, spelling is an act of seeing or hearing accurately what may be written or spoken, and translating that visual or aural image into motor activity. If the image is correct and the motor control is accurate, the word will be spelled correctly, otherwise an error will result.

In treating the causes of misspelling, the physiological basis will be discussed only incidentally. The causes which will be discussed are largely due to the methods of presentation, or to habits which have been formed by the child either before, or after he enters school, or to both of these causes combined.

In the early school, spelling was an independent study, even being used as a method of learning to read. It was impossible to understand how one could read if he could not spell. Drill in repeating the letters in their proper order was the important thing. In 1897 Rice questioned the value of this drill. Did it pay? Did we get the results which ought to be expected considering the time spent on the subject? He decided that we did not. Other investigators have taken up the study until we have a large mass of literature dealing with the subject of spelling in all its phases, and its value to the child and the community.

The aim of all teaching of spelling should be to give to the pupil the ability to spell a word correctly when it is needed. Our business men claim that the schools are failing in this particular. If our pupils are misspelling words which they ought to know how to spell, what is the reason? A knowledge of the causes of errors should lead to methods of eradicating the errors.

Table I shows the common misspellings and the number of times those misspellings occurred. The first column gives the list of words arranged in alphabetical order. In the second column is shown the number of times the word was misspelled.

In the next column is shown the number of different ways that the word was misspelled. Following this column are eight columns showing a few of the ways the word was spelled and the number of pupils spelling the word in this particular way. Where the words were misspelled in a given way by only a few pupils it has not been reported.

There are six causes of misspelling that will be considered in this paper: poor visualization or hearing, pronunciation, the vowel, the consonant, silent letters, and length of the word. These causes have been determined by a study of the 14,447 misspellings of the 50 words given to 993 pupils of the ninth grades in the three towns near Boston.

Visualization and Hearing

People are divided into six types, or classes depending upon how they receive impressions and how those impressions are remembered. These types are known as visuals, those who receive practically all their images through the eye; the audiles, those who receive their impressions through the ear; motiles, those who receive their impressions through motor activities; then the three types which may be made from a combination of any one with the motile and the combination of all three. The most common types are the combinations especially the visual-motile.

The aim of teaching spelling is the correct writing of words, a process which depends mainly upon a correct visual, or audile image coördinated with the correct motor control. In order then to get correct spelling from our pupils we should use these forces and work for a better training of the senses involved.

Ordinarily our methods of teaching spelling do not take advantage of sense training to the extent that is possible, or desirable. The method in general use is the teaching of the words, the study of the words by the pupil, either in the way suggested by the teacher, or in some way that the pupil devises for himself, followed directly, or at some time during the day of the lesson by a written test of the ability of the pupils to spell the words studied. In many cases the first step is left out entirely, and the pupil left to learn the spelling of his list of words as best he may. The fact is, *testing* in spelling has been far more important than the *teaching* of spelling.

TABLE I.
Showing the Common Misspellings, the Number of Times Spelled in a Certain Way

Words	Times Misspelled	No. Diff. Ways Misspelled	Misspelling	No. of Times	Misspelling	No. of Times	Misspelling	No. of Times
all right.....	623	17	alright.....	321	all-right.....	128	allright.....	124
autumn.....	278	27	Autumn.....	170	autum.....	36	autum.....	34
bicycle.....	475	60	bicycle.....	220	bycycle.....	50	bycle.....	32
boundary.....	155	18	boundry.....	100	boundary.....	35	beureau.....	34
bureau.....	372	97	beureau.....	42	beauro.....	36	beureau.....	22
business.....	154	20	buisness.....	82	bussiness.....	19	bureau.....	22
busy.....	58	12	busy.....	33	bussy.....	10	business.....	22
calendar.....	313	18	calender.....	239	calander.....	32	business.....	9
chopped.....	117	17	choped.....	77	chop.....	12	callendar.....	9
column.....	122	26	column.....	41	collum.....	13	chopted.....	7
daughter.....	29	14	daughther.....	6	collum.....	4	colune.....	10
denominator.....	212	60	denomenator.....	35	dauther.....	4	denomnator.....	15
dining.....	343	8	dinning.....	262	denominator.....	26	dying.....	21
does.....	43	8	dose.....	36	dineing.....	32	dosent.....	16
doesn't.....	254	32	does'nt.....	91	doesn't.....	62	dosn't.....	16
especially.....	237	99	especialy.....	41	especialy.....	18	especialy.....	9
February.....	268	22	Febuary.....	126	February.....	92	February.....	11
fortieth.....	250	55	fourtieth.....	69	fortyeth.....	22	fourtheth.....	11
handkerchief.....	285	51	hankerchief.....	113	handkercheif.....	26	forthieth.....	11
knead.....	269	17	kneed.....	129	nead.....	71	handkerchief.....	22
laughed.....	145	10	laught.....	54	nead.....	71	need.....	40
Massachusetts.....	241	56	Massachusctts.....	46	laughted.....	50	laught.....	30
mischievous.....	472	65	mischeivous.....	83	Massachusctts.....	45	Massachusctts.....	10
misspell.....	447	10	misspell.....	335	mischievous.....	59	mischeivous.....	38
mortgage.....	507	22	morgage.....	381	mischeivous.....	59	mis-spell.....	13
					misspelled.....	50	mispelled.....	15
					mortage.....	60		

When there has been any teaching of the spelling word, it has generally taken the form of calling attention to the printed word in the book, or of presenting the word in writing on the board. If the book is used attention is directed to what the teacher considers the difficult parts of the words. If the presentation is made from the board, the troublesome letters are written in colored chalk, or otherwise marked. The point to be emphasized is that every word has some troublesome letter, or letters. These disturbing parts should always be impressed on the mind of the child at the first session with the word, if possible. Thus, the law of primacy which states that first impressions are more lasting is taken account of.

This method has a tendency to appeal to the visuals, but does not generally take the necessary steps to secure a reliable coördination between the visual image and the correct motor control. Without this latter, a valuable aid in the teaching of spelling is lost sight of. However, writing the words in practice to gain motor control, without voluntary attention may do more harm than good in securing this coördination.

Pronunciation

The second cause of failure to spell words correctly is pronunciation. When the child enters school he has a number of words which he can use in his endeavor to convey his thought through speech to some one other than himself. This number varies from 500 or 600 to as high as 1500, and depends largely upon the environment under which the child has grown up. If he has had the advantages of city, country, and seashore life, his vocabulary should be correspondingly large. If he has lived the most of his life in the back alley it will be small. The pronunciation of these words will be good, or poor, very largely as the pronunciation of his father, mother, and associates is good, or poor.

The habits of wrong, or correct pronunciation formed in the early years of the pupil's life, undoubtedly create a background which will materially aid the teacher in her work of teaching pronunciation, or greatly hinder it.

Pronunciation enters into the question of teaching spelling in two ways. First, when the pupil through his early habits has a wrong pronunciation, he must be given the correct one

upon his entrance into school. It is difficult to teach the correct spelling of "again" to a child who pronounces it "agin," or the spelling of "debt," when the pupil pronounces it as though it was spelled d-e-p-t. Second, pronunciation enters into the spelling lesson when a new word arises which has not entered the experience of the child. It is a fundamental principle of child psychology that it is only through experience that we gain any knowledge of the things about us. Also that the activity through which the knowledge is gained must be self activity. Our spellers present a series of words primarily for the purpose of having pupils learn how to spell them. Many of these words have never entered into the experience of the child. Under existing conditions this fact can be considered only incidentally. The important consideration is that the pupils must learn to spell the words of the day's lesson. If they do not know the meaning of the word from experience, we undertake to force it into their experience, and at the same time get them to learn the pronunciation by recourse to the dictionary. The results are many times deplorable.

Suzzallo calls attention to this same fact in his little book, "The Teaching of Spelling." He says that as long as the spelling lesson deals with words which the child has gained through experience, pronunciation plays a small part in the spelling lesson. The translation of an experience into a spelling is comparatively simple. When we undertake to translate the spelling of a word into an experience is when the difficulty begins.

There are two modes of learning the pronunciation of a word: First, by imitation; second, by the study of the letters, translating their phonetic sounds into written symbols. Each of these methods may result in the misspelling of a word.

In the first method the pupil may not hear correctly what is said by the teacher or pupil. As a result the child spells what he hears and not what is said. On the other hand there may be faulty articulation on the part of the teacher, or pupil, resulting in misspellings. Misspelling resulting from these two causes can be detected fairly easily, although which cause is operating cannot be determined. However, it is common knowledge that no one articulates so clearly and distinctly as he ought. For examples of this type of error, let us consider some of the misspellings shown in the test.

"Boundary" was misspelled 155 times, and in 65 per cent. of these cases the word was spelled b-o-u-n-d-r-y, which seems to be a probable case of poor articulation. Other cases may be "mischie-f-ous" for "mischie-v-ous," or the spelling of the same word with an "i" or an "e" following the "v," so that the spelling would be "mischie-v-i-ous." That one of these vowels followed the "v," or "f" in place of "v," in 38 per cent. of the cases, is surely significant. The teacher may be using faulty articulation, or she may be allowing the pupil to use it without sufficient emphasis upon the correct pronunciation to counteract the bad habit that has been formed. "Picture" for "pitcher" is another case of the same type. This resulted in an error in 54 per cent. of the cases. "Quite" is spelled for "quiet" 69 per cent. of the time, and "quiet" is spelled in place of "quite" 43 per cent. of the time. "Vegetable" in place of "veg-e-table" is another case of poor articulation.

Learning to pronounce by translating the phonetic sounds into words, probably results in a much larger number of errors in spelling. These errors are from two causes.

First, many of the letters of our alphabet have more than one sound. This is especially true of the vowels and is probably the reason that vowels are so apt to cause the misspelling of the word, as pointed out in a later section of this paper.

Second, the pupil is taught to use the phonegram as a means of translating the sound into the written word. Here again, however, the phonegram used and the spelling required may not agree. If the word is outside of the experience of the child, he has only analogy to guide him and the result is a large number of misspellings.

The use of analogy in spelling is very common. As a misspelling it may be a lapse, but more often it is probably a definite effort on the part of the pupil to spell the word correctly. When the misspelling is the result of using analogy as a means of spelling a word, the same form of misspelling is rarely used by a large number of children. Yet combined, it forms a large percentage of those who miss the word. For example, "all right" was spelled "a-l-l-w-r-i-g-h-t," "a-l-l-w-r-i-t-e," "a-l-r-i-t-e." "Boundary" was spelled "b-o-w-n-d-a-r-y"; "bureau," "b-u-r-o-u-g-h" and "b-u-r-r-o-w"; "column," "c-o-l-u-m-b"; "daughter," "d-o-t-t-e-r"; "doesn't," "d-o-z-e-n-t"; "patient," "p-a-t-c-i-e-n-t"; "quotient," "q-u-o-c-h-i-o-n"; "used to," "y-o-u-s-t-e-r."

The question of pronunciation looked at from this point of view becomes an important question in any consideration of the causes of misspellings. The pupil determining the pronunciation sometimes by himself, or upon the poor articulation of another person, has started a habit which if allowed to grow, will be a difficult one to break. Even if the error has been discovered soon, the law of primacy, that first impressions are lasting, has placed a handicap upon the pupil.

Effect of the Vowel

Our written alphabet is composed of three kinds of letters, those that extend above the line, those that extend below the line, and those that are only one space high. The vowels belong to the latter class of letters. Just how far this fact has to do with the misspelling of the word is not certain. What is certain is that there is nothing characteristic about the vowel to mark it from the other letters that are only a space high, and this lack of any characterization may make it difficult to fix the visual image of the letter. On the other hand, the fact that our vowels have so many different sounds, makes it difficult to fix the audile image. How much these two factors contribute toward the misspelling of a word is problematical. That the vowel in the word is almost sure to cause trouble is shown by the study of the misspellings of a group of children.

The effect of the vowel in causing misspellings may be illustrated by the following. "Especially" was misspelled 99 different ways by 237 different children. Of the different ways that it was misspelled, 14 per cent. used "a" as the first letter, and 31 per cent. used "a," "i," "ea," or "ei" in place of the "e" for the second vowel in the word. Following this there was a general mix-up in the vowels "ia." A fact that adds significance to these statements is that "s," "l," and "y" were written in every misspelling, while "p" was written every time but four. The letter "s" is a single space letter, but it has a very distinctive sound which probably accounts for its universal appearance.

"Bureau" caused a great deal of trouble in arranging the vowels in the acceptable manner. One pupil evidently desired to spell it as easily as possible and still get all the sounds in, and so spelled it "b-u-r-o." Others appreciated that it was a difficult word and wished to get enough letters in. The result is that we have "b-e-a-r-o-u-g-h," "b-e-a-u-o-u-g-h-t," "b-r-e-a-r-e-a-u," and

"b-u-e-r-a-e-u." The largest number spelling it any one way is represented by the 42 pupils who spelled it "b-e-a-r-e-a-u." It is closely followed by 36 pupils spelling it "b-e-a-u-r-o" and 34 pupils spelling it "b-e-a-u-r-e-a-u." An interesting fact in connection with this word is that the letter "b," that extends two spaces above the base line occurs in every word.

"Bicycle" is another word which causes trouble. Is it "b-i-c-y," "b-y-c-i," "b-i-c-i," or "b-y-c-y"? Of the 475 pupils misspelling the word, 242 or 51 per cent. chose "b-y-c-i," 34 or 7 per cent. chose "b-i-c-i," and 56 or 12 per cent. chose "b-y-c-y." The remaining 30 per cent. had trouble with other parts of the word. Again all but one began the word with a "b" and that one used a "p," spelling it "p-y-s-i-c-l-e."

"Occurrence" is another word in which the vowel causes trouble. Twenty-five per cent. of the misspellings began with an "a." The second vowel caused some trouble, and the last syllable is the cause of a large part of the errors. Of those who misspelled the word, 41 per cent. spelled the last syllable "a-n-c-e," 26 per cent. spelled it "e-n-c-e," 17 per cent. spelled it "e-n-t-s" and 7 per cent. spelled it "a-n-t-s." Thus this point might be amplified. Is the "e" in "ninety" kept or dropped? Is "Saturday" "ur" or "er" for the middle syllable? How are the vowels arranged in "quite" and "quiet"?

Thus it is seen that the vowel plays a very important part in the misspelling of the word, due probably to two causes: first, the large number of sounds that any vowel may have; and second, possibly to the fact that the vowels are only one space high, and lack a certain characterization.

Effect of the Consonant and Its Doubling

The consonant does not give so much trouble as the vowel probably for the reason that there are few letters which have similar sounds. More than half of the consonants extend above or below the line and thus make it possible to visualize them more clearly.

The doubling of a letter, generally a consonant, does cause trouble. In "misspell" is it one "s" or two? Seventy-two per cent. of the pupils who made errors decided that there was only one "s." In "parallel," 78 per cent. apparently knew that two "l's" came together, but to get them in the right place and the remainder of the word correctly written was beyond their ability.

A significant point is that of the 384 pupils who misspelled the word, not one misspelled the first syllable.

An interesting and perfectly natural error was the use of "f" for "v" in "mischievous." This is not a case where the two letters have the same sound, but one in which the organs of articulation except the tongue are in the same position. The "f" is the lip sound and the "v" is a throat sound. Twenty-two per cent. used "f" for "v" in their misspellings of "mischievous."

The consonant then does not play so important a part in the misspelling of a word as the vowel. It is largely in the doubling of the letter that most of the trouble arises.

Silent Letter

Most teachers are cognizant of the fact that the silent letter is an important cause in the misspelling of a word. One would probably find the silent letter given attention in any teaching exercise more often than any other common cause of misspelling. That the silent letter gave trouble to the pupils who were tested is apparent when one looks at Table I. Five words are prominent on account of the single silent letter in the word. These are "handkerchief," "column," "knead," "mortgage," and "autumn."

In "handkerchief," 53 per cent. of the pupils who spelled it wrong simply left out the silent "d," 82 per cent. left out the "n" in "autumn," 69 per cent. left out the "n" in "column," 81 per cent. left out the "t" in "mortgage," and 47 per cent. left out the "k" in "knead." It is true that some of the pupils made other errors, but the above figures show that if they had written the rest of the word correctly more than half of the children would have had the word wrong simply because of leaving out the silent letter.

Length of Words

The errors under this head are probably due to two causes: (a) the difficulty of obtaining an image of the word as a whole, (b) the physiological difficulty which arises from not being sure just where you are in the word as you write. Many of the so-called lapses are probably due to this cause.

In regard to the first cause it is known that it is impossible to visualize more than four or five objects at one time. The result is that in a long word like "superintendent," it would be necessary to make four, or possibly five, movements of the eye

before all the letters could be seen. This means that the first group of letters would have to be remembered while looking at the second group, and so on. In other words, considerable care must be exercised before the letters in a long word can be seen in their true relation. Added to this, the coördination between the visual image and the motor image is made with considerable difficulty, and is undoubtedly the cause of many errors.

In tabulating the number of times each letter was used, two interesting points are noteworthy: (a) In place of the first "e",—"a," "i," and "ie" are used, and in 22 per cent. of the cases the vowel and the "r" following are interchanged. In place of the "i,"—"a" and "e" are used. In place of the second "e,"—"a" and "i" are used. In place of the last "e,"—the use of "a" occurs in about half of the cases with the use of "i" very rarely. The interchange of "d" and "t" in the word is noticeable. This tends to bear out what was said under the section upon vowels and consonants. (b) Making a distribution of the letters as they occur in the misspelling, the following results are shown:

	S	U	P	E	R	I	N	T	E	N	D	E	N	T
Per cent. of occurrence	100	100	100	89	86	62	62	67	82	89	92	95	87	82

That is, the first three letters occur in every one of the misspellings. The "e" or one of the other vowels and the "r," either in its proper place or interchanged with the vowel occur in about the same percentage of the misspellings, 89 per cent. and 86 per cent. respectively. The three letters "i," "n," and "t," forming nearly the central group, occur respectively in 62 per cent., 62 per cent. and 67 per cent. of the misspellings. There is a gradual rise in the last part of the word with a drop in the percentage of occurrence for the last two letters. After the first three letters, however, there is never a return to 100 per cent. This would seem to point to the fact that in a long word the emphasis should be placed on the middle of the word, providing there is no inherent difficulty in the first part of the word.

CONCLUSIONS

1. There are two important causes of misspellings: first, the inability to form an image, either visual, audile, or motor, of the word which is being considered; and second, the inability

Below is given a list showing the various ways in which "superintendent" was misspelled, and the number of pupils spelling the word in the way indicated.

Superintendent—101

supantendant	1	supertan	1
supendient	1	supertant	2
supentendant	1	supertanted	1
supentendent	2	supertatain	1
superadenent	1	supertenant	1
superandent	1	supertendance	1
superantant	1	supertendant	21
superantendant	1	supertendend	1
superantendent	1	supertendent	37
superdendent	1	supertender	1
superdentent	1	supertendient	1
superdendent	1	supertentant	3
superendenent	1	supertindant	1
superendent	4	supertindent	1
superendient	1	supitendant	1
superentedent	1	supintendent	5
superenenant	1	supintentant	1
superentendant	21	supirentendant	4
superentendent	46	superintendent..	1
superententent	1	supredendant	2
superentindent	2	supredendent	1
superident	1	supreintendent	2
superientendant	1	suprendent	1
superindendant	2	suprentendant	6
superindendent	6	suprentendend	1
superindenent	2	suprentendent	13
superindent	7	supretendant	7
superindentant	4	supretendent	7
superindentend	2	supretender	1
superindentent	5	supretin	1
superindetand	2	supretindent	1
superinten	1	supridendent	1
superintenant	2	supridentant	1
superintenat	1	suprindentent	1
superintend	1	suprintendant	4
superintdentent	1	suprintended	1
superintendant	224	suprintendent	16
superintended	1	suprintentant	1
superintenden	1	supritudent	1
Superintendent	32	supritudent	2
superintender	1	supruntent	1
superintendint	5	suptendant	1
superinteneat	1	supter	1
superintenent	1	supterdent	2
superintention	2	supterindent	1
superintentend	1	supterintendent	1
superintindent	1	suptertendent	1
superitendent	2	suptientien	1
superitentend	1	surertendant	1
superntendant	6	surpertenant	1
superntendent	4		

to translate the pronunciation of the word into a spelling, unless the word becomes a part of the experience of the child.

2. There are four minor causes for the misspelling of a word.

The effect of the vowel

The effect of the consonant

The effect of the silent letter

The effect of a long word

The vowel becomes a cause because of the large number of sounds given to each vowel in the English language, with a possibility that our vowels, being only one space high, are not easily visualized. The consonant becomes a cause largely on account of its being doubled in the word. The long word becomes a cause on account of the inability to visualize the word as a whole, necessitating a number of eye movements, thus breaking the word into parts which may or may not correspond to the syllables of the word. The difficulty of making a perfect coördination between the visual image and the motor image, thus enabling the pupil to write the word correctly, is responsible for a large number of errors.

THE EDUCATION AND CONTROL OF THE EMOTIONS

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It is coming to be recognized more and more clearly that the native tendencies and capacities of the child furnish the raw material which it is the function of education to work over and to make available for the needs of the individual as an efficient member of society. In the past, the school as an educational institution has devoted its energies almost completely to the cultivation of a selected portion of this native equipment of tendencies and capacities, namely those which are concerned in the processes of cognition—the intellectual processes. The emphasis in the work of education has been put upon the development of the “mind,” and has stressed such factors as memory, reasoning, abstraction, generalization, and the like. To that portion of the native equipment which includes the affective side of life, made up largely of what are known as the feelings and the emotions, comparatively little attention has hitherto been paid.

The school's neglect of this large and important part of our native equipment has been due to three reasons: (1) a mistaken conception of the school as an institution adapted primarily, if not solely, to the training of the intellectual “powers and capacities,” and the inculcation of knowledge in the shape of information; (2) a lack of comprehension of the value of the emotional side of life; and (3) the absence of any method or system which might be applied to the training of the emotions in the same way that method is applied to the intellectual subjects. All three of these reasons have continuously been operative, although of course not always with the same degree of influence. The school has been narrowly intellectual; the emotions have been undervalued, even to the extent of being looked upon, with only a few exceptions, as detrimental and fit only for control by repression; and so complex is the question of their origin and nature that very few principles relating to their education can be laid down, to say nothing of any systematic method. Difficult as it has been to develop a method for the education of the intellect, it is a still more difficult task to formulate a

systematic method which may be applied to practical use in the education of native capacities of whose real nature we are so ignorant as we are of the emotional tendencies.

But these reasons for the neglect of the emotions in both the theory and practice of teaching are beginning to lose their cogency. The school is taking on a broader life, and is no longer content to leave the development and training of the emotions entirely to outside influences. Educators of the present day realize the necessity of making use of all the capital afforded by original nature, for they have come to see that the mind is not composed of intellectual and emotional faculties set over against each other, but that there is a very vital connection and interplay of thoughts with feelings. A saner understanding of moral questions has accompanied the growth of the idea that original nature cannot be essentially "wrong," and we have come to understand that features of the emotional life which have heretofore been looked upon as fit only for repression, need only control and redirection to become of the greatest value; and that we cannot at all afford longer to leave them out of account in our educational scheme. We are also making progress in our knowledge of how to control and educate the emotions. The great and increasing interest which psychologists are showing in topics connected with the nature and origin of the affective states has led to a better understanding of them, and has given us practical suggestions as to methods of their control. It is true, as I have said, that nothing like a system, in the pedagogical sense, has yet been formulated, and that as yet most of the literature upon the education of the emotions is devoted to a discussion of the end that should be reached, rather than of the methods by which the desired result may be accomplished. But what we have serves at least as a beginning, and it is not too much to hope that some day, and not so very far distant, we shall have a practical method for the development and control of the emotional life.

Although this topic has suffered such neglect, it is one which is of the greatest importance. The school wishes to know how to provide for the proper development of the right kind of emotional life in its pupils. Individuals wish to know how to favor the development of the good emotion, and to call it into being; and, more often perhaps, how to inhibit the expression of injuri-

ous emotional states. A knowledge of how to influence the feelings of others, of how to produce a desirable emotion or discourage the appearance of an undesirable one, would be of the utmost value to any teacher in the work of imparting instruction, as well as in the attempt to develop a well-balanced emotional life in his pupils. Nothing more than a few hints is as yet available for guidance in this kind of work, but meager as our information is, it is of great practical value, and any teacher who makes a really serious effort to apply it will secure important results.

The training of the emotions, as the training of all the instinctive tendencies, involves the encouragement of the useful ones, including provision for their exercise; the careful direction of those which either good or bad, according to the nature of their objects; and the discouragement, by inhibition or redirection, of those which are positively harmful. In this latter case, inhibition may take place by direct repression or by substitution. Probably no more common or characteristic device for educating or training the child's emotional reactions is used by adults than direct repression. Many parents have the habit of saying "Don't" to almost everything which the child has a mind to do. This sort of repression may be effectual in subduing at least a part of the outward expression of the emotional state, but as a means of control it is incomplete, because it does not go back to the source or beginning of the emotion; and it may result in actual damage because of the repression of the outward act, while the emotional stress goes on under the surface just the same, although denied its natural outlet.¹

Of course, the general rule by which a teacher may be guided in his effort to develop good emotions is to provide every opportunity for the origin of such emotions, and then to see to it that the proper expression of the desired feeling is rewarded with pleasure, so that a definite connection may be set up between the emotional state and the pleasurable consequences. Conversely, in case of the harmful emotion, as far as possible every situation which tends to call it forth should be avoided, and unpleasant consequences should be connected with its expression.² This use of pleasant or unpleasant results is only an

¹ BURT, C. "*Psychology and the Emotions.*" School Hygiene, May, 1916.

² THORNDIKE, E. L. *Principles of Teaching.* P. 198.

application of Spencer's "doctrine of natural punishments." Its value here lies in the fact that experience, which involves the natural force of individual and social consequences, is a great mold of emotional life.³

Among educational writers a favorite prescription for the training of the emotions in connection with the work of the school is to use to this end art and literature, including biography and history. Horne, who has made a definite attempt to formulate a pedagogy of the emotions, places much emphasis upon this point, saying that art, literature, and history are the most effective instruments in educating the feelings;⁴ and Bagley makes history, religion, literature, and the various forms of art the chief media for the transmission of emotions.⁵ The psychological basis for all this is in the law that to arouse any emotion, we should arouse ideas which have gone with that emotion in the past.⁶ If the child has not sometime experienced the desired emotion in connection with the ideas which are presented to him by the work of art or literature, or which come up by association, he will not feel it, except in the possible case of a situation so vivid as to arouse an instinctive response. It may be possible for the teacher, however, by presentation of different ideas, finally to call up the emotional state which is sought. The difficulty in doing this will depend, of course, upon the nature of the particular emotion or sentiment, and especially upon the frequency with which it is found to exist among children of the given age. It must be remembered, also, that the situation as presented in a picture, for example, does not call up precisely the emotion that would accompany the actual event. What we actually have in such a case is an aesthetic emotion—what Thorndike calls a "pseudo-emotion"—which does not cause the same strain as an actual emotion. But these emotions contribute much to the richness of life, and their reactions are not nearly so fatiguing as are those of the real emotions, which, in general, should be aroused only for the sake of action.⁷

A method of arousing a given emotion in a given situation, which is somewhat analogous to the teacher's use of art or liter-

³ READ, M. S. *An Introductory Psychology*. Chapter XIII.

⁴ HORNE, H. H. *Psychological Principles of Education*. Part III.

⁵ BAGLEY, W. C. *The Educative Process*.

⁶ THORNDIKE, E. L. *Principles of Teaching*. P. 199.

⁷ THORNDIKE, E. L. *Principles of Teaching*. Pp. 200-202.

ature, is the communication of it through imitation. "If the teacher and half of the class are thrilled with admiration for a member of the class who has honorably confessed his unfairness toward a classmate, the rest of the class will be more likely to admire him also."⁸ This is only a particular case of suggestion, or the influence of the "strong idea," which may also sometimes be used by one individual over another, for the "spread" of an idea or sentiment, which may go on to completion in an overt act.

As an outgrowth of the James-Lange theory of the bodily origin of the emotions—although the principle was acted upon before that theory was announced—we have the insistence upon the bodily attitude of the expression of a given emotion as a means of furthering the development of that emotion. This method of emotional control is perhaps more frequently mentioned than is any other. James says that, within the limits of verification, experience corroborates rather than disproves the statement, correlative to his theory, that the voluntary arousal of the so-called manifestations of a special emotion ought to result in that emotion itself. Panic is increased by flight, grief is increased by giving way to its outward symptoms, melancholy is induced by a moping posture, and cheerfulness is the outcome of deliberately cheerful conduct. In his investigations, he finds that about one half of the actors questioned upon this point experience the real emotion to which their art gives external portrayal, and he accounts for the other half by saying that in them the visceral and organic part of the expression can be suppressed, and that it is probably on this that the chief part of the felt emotion depends. According to James, then, when we wish to cultivate a certain disposition, we should go through with the movements which make up the outward manifestation of that disposition.⁹

Thorndike follows James in stressing the value of assuming the characteristic bodily response in order to arouse a given emotion, or to establish a desired attitude or disposition. In illustration of how this may be done in practice, he writes:

"Let the frightened one walk steadily toward the enemy, looking him square in the eye, shouting in a loud voice, 'I'm not afraid of

⁸ *Ibid.* P. 199.

⁹ JAMES, WM. *Principles of Psychology*. Vol. II, Chap. XXV.

you, I'll eat you alive,' and brandishing his weapon as if about to knock down an elephant—and fear may be replaced by courage. If the kindergarten teacher who feels disgust at a dirty misshapen baby whose face is covered with sores and pimples will treat him just as she would a dainty, red-cheeked picture of health and cleanliness, take him on her lap, pet him, smile at him and caress him, she will often find disgust giving way to tolerance and even to affection.

"This * * * is indeed the surest way to secure the presence of an emotion. In the long run our feelings grow into harmony with our conduct. Greed cannot live unsupported by greedy acts; the manifestation of love begets it; get pupils to act as they would if the emotion was felt and they will feel it, or, if they do not, will not need to. For in any case they will have the really valuable feature of the emotion, its influence on conduct."¹⁰

Münsterberg says that the feelings are essentially motor reactions, and that it is therefore possible to educate and train them through voluntary control of the movements in which they express themselves. The control of emotion, then, lies in the control of appropriate movements. To get a child to appreciate a picture, for example, put him before it and have him assume a "liking attitude," and the movements of this response will set up the emotion.¹¹ While it is impossible to say to just what extent one can control his emotions and feelings by assuming appropriate bodily attitudes, there must be something in the principle that, in order to cultivate a certain disposition, one must act as if he already possessed that disposition.

In order that the emotional life may be sound and healthy, the same conditions must be true for the body. Bodily health and activity make for a normal and happy emotional life. The emotions should have serviceable outlets, through right motor expressions. Burt insists upon the need of an "emotional hygiene," which shall include exercises in emotional expression, of some such nature as the system of eurhythmics developed by Dalcroze. Other means of physical outlet may be provided by sports, games, and plays.¹² Support is lent to the argument for provision of these outlets by the recent work of Cannon, who finds that the "coarser" emotional states are accompanied by an increased secretion of adrenalin with its resultant physiological effects.¹³ Crile says that the vitalizing fluids which are

¹⁰ THORNDIKE, E. L. *Principles of Teaching*. Pp. 199-200.

¹¹ MÜNSTERBERG, H. *Psychology and the Teacher*. Chap. XXI.

¹² BURT, C. "Psychology and the Emotions." *School Hygiene*, May, 1916.

¹³ CANNON, W. B. *Bodily Changes in Pain, Hunger, Fear and Rage*.

thus released may cause physical injury unless they are consumed by action, and that an unexpressed emotion is measurably relieved by muscular activity. For furnishing such relief, the value of games, especially such as take the form of a contest, is apparent.¹⁴

According to Pillsbury, the only real control of emotions is that which is effected at the source, and this is available only to some degree. His recipe for emotional control is to classify, and thus control, the situation which calls the emotion forth. The control of emotion, or of emotional expression, therefore, is chiefly in terms of the attitude which one takes toward the stimulus. This attitude is to a considerable extent under one's control, at least when falling outside that class of fundamental instincts which are most closely linked with their stimuli. Sensations and stimuli which are capable of being classified in different ways arouse different emotions upon the basis of that classification. For instance, a chance remark may be classified as an insult and arouse the emotion of anger, or the same remark, coming from a friend, may be classified as a jest and arouse an emotion of an entirely different sort.¹⁵ This "control of attitude" is a sort of all-inclusive expression which covers several principles to which various authors have given different names. It really implies the inhibition of emotional expression by the application of the judgment,—the "intellectualization" of the situation, so to speak. It involves, as Thorndike says, learning to judge the situation objectively by the facts, not subjectively by the feelings about those facts; and then following the judgment rather than the feelings.¹⁶

If the emotional situation involves a personal stimulus, this application of judgment may have the effect of changing the stimulus from a personal to an impersonal nature, so that when the personal elements are once taken out of the stimulating situation, the emotional reaction loses its "zest" and rapidly fades away.¹⁷ Since feelings can thus be reached indirectly through ideas and actions, it is possible sometimes for a teacher to relieve an over-emotional state in a child by counseling and

¹⁴ CRILE, G. W. *Origin and Nature of the Emotions*.

¹⁵ PILLSBURY, W. B. *Essentials of Psychology*. Chap. XII; *The Fundamentals of Psychology*. Chap. XIV.

¹⁶ THORNDIKE, E. L. *Principles of Teaching*. P. 96.

¹⁷ BURT, C. *Psychology and the Emotions*. School Hygiene, May, 1916.

reasoning with him. Explanation of the situation in all of its bearings may change the object of the feeling and draw it off into harmless or, it may be, even into useful channels.¹⁸

Another way in which the expression of an emotion may be prevented is by "directing the attention" to something else, until the occasion for the emotion is past. A person who found himself in a situation normally provocative of anger, and who did not wish actually to become angry, might be able to turn his attention to something, inside or outside of the situation, of such a nature as to make it possible to "keep his mind," as we say, off the particular factor which would otherwise stir up the emotion which he was seeking to inhibit.¹⁹ In effect, this is but another application of the principle of bringing about a change in the stimulus, without necessarily involving "reclassification."

Of those emotions which are good or bad only as they are directed to objects which are proper or improper, the method of control involves simply proper direction. Ambition, pride, anger, and other similar emotions, have their uses and are too valuable to be lost, but unless directed toward the proper objects, they are not only useless, but positively harmful. While hate, for instance, is entirely wrong if directed toward anything or anybody that is not the proper object of that emotion, it is, on the other hand, a matter of great importance to be able to hate aright,—to hate the things toward which that emotion has its proper direction.²⁰

This method of control by direction is very closely allied to what is known as *sublimation*. The Freudians use this term exclusively in connection with the sexual instincts and the emotions connected with them, but by a somewhat similar interpretation it may be made to apply equally well to other emotions. It means the "long circuiting" of the instinct or emotion by associating it with other and better sentiments.²¹ Colvin and Bagley, in their *Human Behavior*, define it as "the method which attempts to lift a strong feeling bodily out of the instinct to which it naturally belongs and to fasten it firmly to another

¹⁸ READ, M. S. *An Introductory Psychology*. Chap. XIII.

¹⁹ PILLSBURY, W. B. *The Fundamentals of Psychology*. Chap. XIV.

²⁰ THORNDIKE, E. L. *Principles of Teaching*. P. 199.

²¹ BURT, C. "Psychology and the Emotions." School Hygiene, May, 1916.

object and to an entirely different process."²² A rather commonly given illustration of this operation is the development of the sentiment of chivalry at about the time of adolescence as a sublimated form of the newly awakened sexual emotions. Colvin and Bagley give two excellent illustrations which I quote:²³

"A very good illustration of an effective attempt to 'sublimate' a primitive instinct is to be found in the success of the Salvation Army. Here we see a military organization with innumerable suggestions of actual physical combat enlisted in the service of the most peaceable of ideals. The Boy Scout movement (as it has been developed in America) makes a similar use of the feelings connected with several of the primitive instincts, attaching them to other objects and insuring responses that are only *symbolic* of the actual primitive responses."

All of this means that an effective mode of emotional control lies in the formation of attitudes, ideals, and sentiments, by attaching appropriate ideas to the original emotion as a core. Much may be done in this connection by deliberate resolution to develop the appropriate attitude. Thus suppose one decides that he does not wish to give way to anger in a certain situation in which he often finds himself. Let him then make a deliberate resolution to avoid that situation as much as he possibly can, and thus give the emotion the fewest possible occasions for being aroused. Let him further resolve that, if he does find himself in the provocative situation, he will by no means allow his temper to get the better of him, that he simply will not become angry, that he will follow his judgment and change the stimulus; and he will have gone a long way toward the accomplishment of his purpose, and started upon a method which will become more and more effective as he continues to practice it.

²² COLVIN AND BAGLEY. *Human Behavior*. P. 159.

²³ COLVIN AND BAGLEY. *Human Behavior*. Pp. 159-160.

THE WEIGHTING OF POINT SCALE TESTS¹

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The Yerkes-Bridges Point Scale as now used is a weighted scale, that is, the various tests are assigned different values in the scoring. For example, test 14, constructing a sentence with three given words, counts only 4 points, while test 15, Comprehending questions, counts 8 points towards the maximum of 100 points. Since the examination has for its object the measurement of mental ability, the tests would be correctly weighted if their scores were proportioned to their respective correlations with general intelligence. Now the only way we have of representing a subject's intelligence numerically is by the result of the mental examination. Hence, the problem of determining the correct weighting of the tests must be solved by a series of approximations.

It would have been simpler to construct a scale with unweighted tests, using either the all-or-none principle of scoring, or partial credits on a fixed scale. Neither of these devices is satisfactory, however.

The all-or-none method is wasteful. To take one of the most obvious illustrations, it requires the same amount of time to give the test of words in three minutes whether the subject responds with many words or few, and it is plain that 25 or 105 words, for example, is quite as significant as 60 (the number credited in the usual Binet test). We are throwing away both time and valuable evidence when, in scoring, we fail to recognize more than one result of such a test.

Again, if we give partial credits on a fixed scale (in this case five points for each test) we assume that all the tests are correlated alike with general intelligence, and the evidence does not bear out this assumption.

The scoring now in use for the Point Scale represents a first approximation to the correct weighting. A second approxima-

¹ This problem was suggested by Dr. R. M. Yerkes, Psychologist, Psychopathic Hospital, as a first approach to the correct weighting of tests for the Point Scale. Being Contributions of the Mass. Commission on Mental Diseases, whole number 184 (1917. 4). The previous contribution was No. 183 (1917.3) by Dr. R. M. Yerkes, entitled "How May We Discover the Children Who Need Special Care?" (to appear in Mental Hygiene Vol. I, No. 2, p. 252.)

tion would naturally be based on a study of the correlations between the scores made on the several tests as now given and the total scores resulting.

These correlations have been computed for three different age groups of the school children whose records were used in calculating the published norms.² They are all children of English-speaking parents and were living in a medium to poor city neighborhood.

Group I consists of those members of the twelve-year-old and the thirteen-year-old age groups whose records show no zero scores, in all 53 subjects. It is roughly the equivalent of a somewhat higher age group, but an unselected group at this age might be expected to show higher correlations.

Group II consists of the entire nine-year-old age group, 43 subjects.

Group III consists of the entire six-year-old age group, 53 subjects.

Table I shows the values of r obtained for these three groups, together with their averages, the tests being arranged in the order of their correlation as represented by these averages. None of the coefficients is negative, but there are several zeros, and some other values are so low that their significance is open to question. The highest correlations appear under Group II. Thus for all three groups there are thirteen values above .60, and nine of these are under Group II, while only two of the eighteen values below .30 belong to that group.

It is noticeable that some of the tests that rank highest in order of correlation for the two older groups also rank well (though not highest) for the youngest group, and some of these, such as tests 4, 6, 9 and 15, could readily be modified by the addition of easier parts so as to be still better suited to the younger subjects.

On the other hand, tests 1 and 11 rank very low in all three groups. Test 11 was looked upon with suspicion at the time when the Point Scale was being developed. So much so that in the earlier form of the record sheet a test (16a) appears as a possible substitute. The line suggestion test was finally retained as being "a fair indication of varying suggestibility" so far as could be judged from the data then available. Judging

² YERKES, BRIDGES AND HARDWICK. *A point scale for measuring mental ability*, p. 66.

TABLE I.
Tests in Order of Correlation

Order	No. of test	Name of Test	Values of r for age groups			Weighting		
			I (12 & 13)	II (9)	III (6)	Av.	Act.	Sug. Th.
1	9	Comparing remembered objects	.53	.73	.49	.58	6	9 9
2	15	Comprehending questions	.64	.68	.40	.57	8	8 9
3	20	Analogies	.58	.71	.42	.57	6	8 9
4	4	Memory for digits	.54	.62	.49	.55	5	7 8
5	13	Words in 3 minutes	.50	.65	.45	.53	4	7 8
6	17	Detecting absurdities	.53	.61	.33	.49	5	5 7
7	6	Repetition of sentences	.43	.59	.38	.47	6	6 7
8	10	Defining concrete terms	.44	.56	.34	.45	8	6 6
9	19	Defining abstract terms	.63	.62	0	.42	6	6 6
10	18	Dissected sentences	.52	.63	0	.38	6	5 5
11	12	Copying square and diamond	.21	.39	.52	.37	4	4 5
12	5	Counting backward	0	.50	.61	.37	4	4 5
13	8	Arranging weights	.19	.37	.51	.36	2	4 4
14	16	Designs from memory	.26	.44	.36	.35	4	4 4
15	7	Reaction to 3 Binet pictures	.17	.30	.54	.34	9	6 4
16	2	Detecting missing parts	.11	.28	.61	.33	4	4 4
17	14	Sentence with 3 given words	.26	.61	.12	.33	4	3 4
18	3	Comparison of lines and weights	0	.57	.29	.29	3	2 3
19	11	Resisting suggestion	.16	.20	.29	.22	3	1 1
20	1	Choosing of prettier	0	.35	.24	.20	3	1 1

from these correlations, however, this type of suggestibility is not highly correlated with general intelligence, and the early suspicions of the test are justified.

The column "actual weighting" gives the scores now in use.

The "theoretical weighting" was obtained as follows. It was assumed that the highest score would be 9, as heretofore, and that in view of the very low correlations of some of the tests, the minimum score should be 1. By means of a graph the tests were then weighted, to the nearest unit, in proportion to the corresponding values of r (Figure 1).

This gave to tests 2, 3, 14, 16 and 19 the same scores as at present. For some others, such as test 9, Comparing remembered objects, the change to the theoretical value is easily made. Subjects often volunteer more than two items of difference in making these comparisons, and if we credit 1 point for 1 item of difference, 2 points for 2 items, and 3 points for 3 or more items, we obtain 9 as the maximum, which is the theoretical weighting. Certain other tests, however, such as test 15, Comprehending questions, do not lend themselves so readily to this

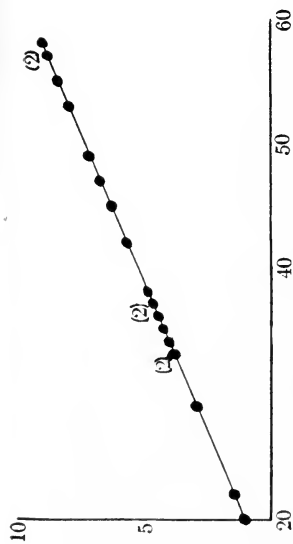


FIGURE 1. Graph for determining theoretical weighting. Ordinates=scores; abscissae=average coefficients of correlation.

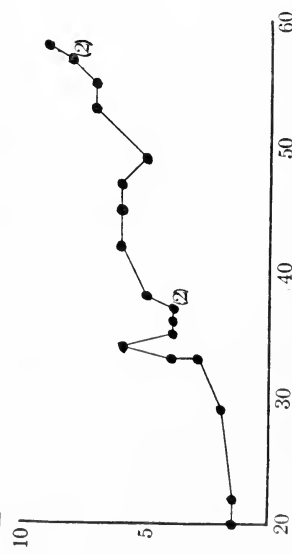
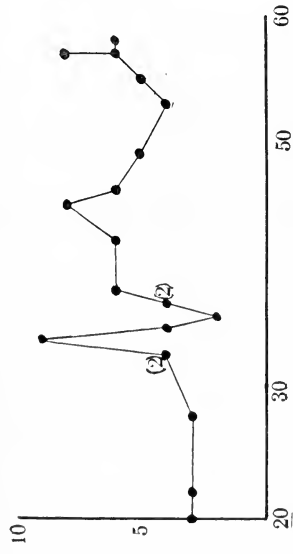


FIGURE 2. Graphs showing relation of actual and suggested weighting to the average coefficients of correlation. Ordinates =scores; for the upper curve the actual and for the lower curve the suggested weighting; abscissae=average coefficients of correlation.

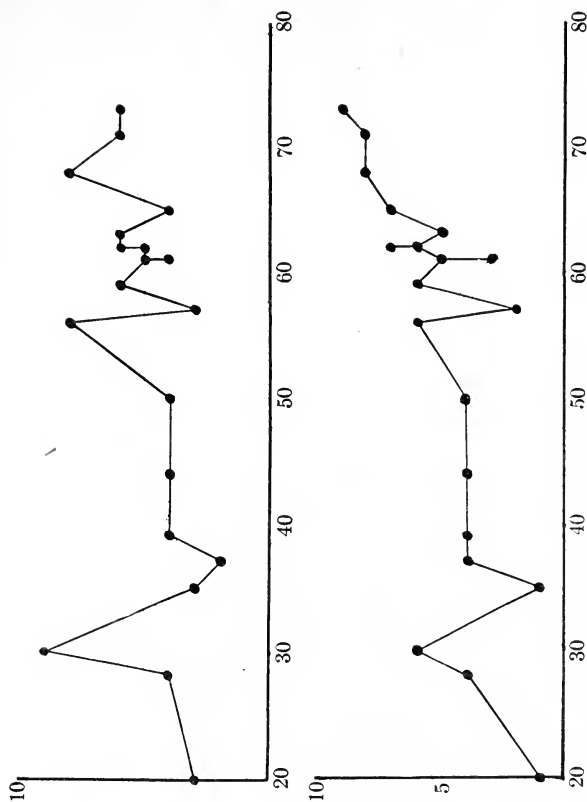


FIGURE 3. Graphs showing relation of actual and suggested weighting to coefficients of correlation for Group II. Ordinates=scores; for the upper curve the actual and for the lower curve the suggested weighting; abscissae=coefficients of correlation for Group II.

readjustment, and the column headed "suggested weighting" represents a compromise between theory and practice. In no case has a score been changed by more than three points, and the modifications have been such as to give a total of 100 points, as at present, instead of the inconvenient 109 which is the sum of the "theoretical" values. Other considerations were taken into account in rating the individual tests. Thus test 7, Reaction to 3 Binet pictures, should theoretically be reduced from 9 points to 4, but its correlation coefficient is .54 at six years and, since this age group is more meagerly represented than the others in the examination program as a whole, this score was held at 6 points. On the other hand, test 3, Comparison of lines and weights, was reduced one point below the theoretical weighting because its only high correlation appears in Group II which has the advantage over both of the other groups in the program as a whole.

The graphs of Figures 2 and 3 indicate the relation of the "actual" and the "suggested" weighting to the order of correlation as represented respectively by the averages for all three groups and by the coefficients for Group II. The curve should approximate that of Figure 1. The improvement is most evident in dealing with the averages, as was to be expected, but it is recognizable also for the nine-year-old group. In Figure 2, the lower curve presents two marked irregularities, namely, a high point for the sixth test in ascending order of correlation and a low point for the fifteenth. The former test is the Reaction to 3 Binet pictures, and the reason for giving to that 6 points instead of 4 has been explained already. The latter is the Detection of absurdities, and this was held at 5 points because of the practical difficulty of deciding how to give the two additional points which theory demanded.

The "suggested" weighting leaves the scores unchanged for eight tests, namely:

- Test 2, Detecting missing parts.
- " 5, Counting backwards.
- " 6, Repetition of sentences.
- " 12, Copying square and diamond.
- " 15, Comprehending questions,
- " 16, Designs from memory,
- " 17, Detecting absurdities, and
- " 19, Defining abstract terms.

For the remaining twelve tests the suggested weighting might be obtained in various ways. In order to try out the new values with the records of some examinations already made, the rules for scoring were modified as follows:

Comparing Remembered Objects

3 points credit for 3 or more correct items of difference.

Analogies

e and f, each, 2 points credit.

Memory for Digits

d and e, each, 2 points for success in first trial, 1 point for success in second trial.

Words in 3 Minutes

15 to 29 inclusive, 1 point, 30 to 44 inclusive, 2 points.

45 to 59 inclusive, 3 points, 60 to 74 inclusive, 4 points.

75 to 89 inclusive, 5 points, 90 to 104 inclusive, 6 points.

105 and upward, 7 points.

Defining of Concrete Terms

b disregarded.

Dissected Sentences

c, 1 point credit.

Arranging Weights

4 points for correct arrangement in first trial.

3 points for correct arrangement in second trial.

2 points if in either trial the arrangement is correct except for the transposition of two consecutive weights.

Reaction to Binet Pictures

No credit for interpretation.

Sentence with 3 Given Words

3 points credit if the 3 words are used in one sentence.

2 points credit if they are used in two sentences very loosely connected.

1 point credit if they are used in two separate sentences.

Comparison of Lines and Weights

b and c together 1 point credit, that is, no credit on these two if there is a failure in any one of the four trials.

Resisting Suggestion

1 point credit if the suggestion is not accepted more than once.

Choosing of Prettier

1 point if not more than one of the three pairs of faces is incorrectly judged.

TABLE 2
Illustrative Records
 (In Order of Increasing Scores)

Order	No.	Sex	Age		Scores		Change in score
			Chron.	Ment.	Act.	Sug.	
1	12	m	6.2	less than 4	16	15	-1
2	6	m	8.5	5.5 N-E	24	22	-2
3	9	f	4.8	5.4	25	22	-3
4	1	m	6.7	7.0	35	30	-5
5	2	f	7.7	8.7 N-E	45	42	-3
6	11	f	8.7	9.2	57	53	-4
7	13	f	14.5	9.2	57	53	-4
8	14	f	19.8	10.7	64	60	-4
9	8	m	14.0	11.2	67	63	-4
10	10	m	13.7	11.6	72	69	-3
11	4	f	19.2	14.0	81	78	-3
12	3	m	14.5	17.5	87	81	-6
13	5	m	14.4	18.0	88	83	-5

(Mental ages marked N-E were computed from the non-English-speaking norms.)

Table 2 shows the effect of this revision in thirteen cases,³ arranged here in order of increasing scores. It is evident that the "suggested" weighting, thus applied, tends to lower the total score by from 1 to 6 points, and that the lowest scores are the least affected. The lowering of the totals might have been anticipated from the fact that in these three groups high correlations are generally found with average scores of medium value, and low correlations most frequently with high average scores (Table 3). This is especially marked in the two older groups. It is what might be foreseen from theoretical considerations. The more highly a given test correlates with general intelligence, the more closely will the curve of distribution for the scores of that test approximate the normal, bell-shaped form, the average score at the same time approaching fifty per cent. of the maximum for that test. On the other hand, if the average score for a certain test is very high or very low we may expect it to show a low correlation with general intelligence. It is to be noted that the situation in this regard is totally different from that which obtains for the Binet age scale in its various forms.

That the lower scores of Table 2 are least affected by the revision is accounted for when it is seen (Table 3) that for Group III some of the lower correlations are found in conjunction with very low scores, the two zero correlations corresponding to zero scores.

³ These subjects are children in the care of the N. E. Home for Little Wanderers, and were examined there as a matter of routine.

TABLE 3
Percentage Values of Average Scores
 (In Order of Correlation of Tests)

Group I				Group II			Group III		
Order	No. of test	<i>r</i>	Av. Score	No. of test	<i>r</i>	Av. Score	No. of test	<i>r</i>	Av. Score
1	15	.64	81	9	.73	80	2	.61	68
2	19	.63	68	20	.71	20	5	.61	25
3	20	.58	57	15	.68	41	7	.54	59
4	4	.54	86	13	.65	48	12	.52	40
5	9	.53	98	18	.63	25	8	.51	20
6	17	.53	76	4	.62	72	4	.49	56
7	18	.52	65	19	.62	15	9	.49	25
8	13	.50	85	14	.61	50	13	.45	15
9	10	.44	81	17	.61	28	20	.42	2
10	6	.43	77	6	.59	65	15	.40	14
11	14	.26	93	3	.57	83	6	.38	65
12	16	.26	73	10	.56	60	16	.36	10
13	12	.21	93	5	.50	95	9	.34	41
14	8	.19	95	16	.44	30	17	.33	2
15	7	.17	84	12	.39	75	3	.29	57
16	11	.16	93	8	.37	70	11	.29	37
17	2	.11	100	1	.35	100	1	.24	77
18	3	0	100	7	.30	71	14	.12	1
19	1	0	100	2	.28	93	19	0	0
20	5	0	100	11	.20	50	18	0	0

In making up this group for purposes of illustration the intention was to include as great a variety as possible, in the hope that some of the changes in score might be of interest in connection with the types of case involved.

Subject No. 1 shows an unexpectedly heavy loss. He did surprisingly well in the examination and in some "performance" tests which were given him, but in the early part of the interview his expression and manner gave a strong impression of feeble-mindedness, and some of his social reactions, as reported, are suggestive of mental deficiency.

In the other cases the effect of the change in scoring seems to be correlated with the total score and not at all with the type of case. Thus No. 11 is a normal child of a good type mentality, while No. 13 is a high-grade defective and calls for institutional care. Yet their scores are identical for both ways of reckoning.

As the rules followed in these illustrative cases might seem arbitrary, the score was made up by proportion for one subject, No. 5 in Table 2. Using the suggested weighting his score becomes 86.6, and using the theoretical weighting and reducing to the scale of 100, it is 84.3. This indicates (1) that correct weighting would tend to lower the total scores, (2) that the sug-

gested weighting does not tend to lower them unduly, and (3) that the rules followed in working out the illustrative cases are only approximately satisfactory.

In scoring test 7, it is a question whether it was justifiable to disregard interpretation. It might be fairer to disregard entirely one of the three pictures. It is doubtful, however, whether in the present form of the test failure to interpret should be allowed to count against a subject. Some of the ablest individuals do not understand the question in this sense. As the test is modified in the adult scale this objection is removed, and the score may be expected to show a much higher correlation with general intelligence.

Comparison of the values of r with the actual scores indicates that higher correlations tend to appear for those tests which offer the greatest number of possible gradations in the scoring. Hence, if test 13 is scored as in the illustrative cases it may be expected to show a higher correlation than at present. It is likely, moreover, that the improvement would be greatest for Groups I and III where this test is now weakest. The separation of concrete terms and abstract terms, so as to make two tests in defining, seems artificial, and if these tests (10 and 19) were treated as one, a higher correlation might be expected to appear. A like statement might be made in regard to test 3, b and c, Comparison of weights, and test 8, Arranging weights.

AN ANNOTATED BIBLIOGRAPHY OF RECENT LIT-
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115. FERNALD, GRACE M.: *Report of the Psychological Work in the California School for Girls*.
J. of Delinq. 1916, 1: 22-32.
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 124. FREEMAN, F. N.: *Tests*.
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A resume of the year's literature and the advances made in using the scale
 125. FREEMAN, F. N.: *Tests*.
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A review of some of the test literature.
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Psychol. Bull. 1915, 12: 187.
A brief discussion of the test contributions during the year 1914.
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A thesis presented to the Dept. of Education, Leland Stanford Jr. University, May 5, 1914.

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130. GATES, A. I.: *The Mnemonic Span for Visual and Auditory Digits.*

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"The average span for college students is approximately 8.2 digits when the visual method of presentation is employed, and 7.7 digits with the auditory method."

131. GAULT, R. H.: *Preventives of Delinquency.*

J. Crim. Law & Criminol. 1914, 4: 637-641.

Cites case from unpublished report of Dr. Bernard Glueck of an Italian testing only 9 who accumulated a fortune in America, returned to Italy, purchased a farm, and returned to America to repeat the process. This individual was pronounced defective. Discussion of mental tests as aids in preventing delinquency.

132. GAULT, R. H.: *The Laboratory in the Criminal Court.*

J. Crim. Law & Criminol. 1914, 5: 167-169.

Reporting the findings of the Psychopathic Laboratory connected with the Chicago Courts.

133. GIESE, FRITZ: *Ueber die Testdiagnose*

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The scale is not as valuable for adults as for children. For adults special tests are required to determine individual differences in function.

134. GODDARD, H. H.: *Percentage of Feeble-mindedness that is Hereditary According to the Degree of Defect.*

Paper read before Amer. Psychol. Assoc., 1914.

(Abstracted in Psychol. Bull. 1914, 11: 61-62.)

The higher the intelligence among the feeble-minded, the greater the possibility of transmitting mental defect. Feeble-minded children tend toward the same intelligence level possessed by their parents.

135. GODDARD, H. H.: *Two Cases of Criminal Imbecility.*

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A discussion of two feeble-minded murderers examined with the scale.

136. GODDARD, H. H.: *The Binet Measuring Scale of Intelligence: What It is and How It Is to be Used.*

Training School Bull. 1914, 11: 86-91.

School instruction has slight if any influence on scale ratings. Scale most accurate and practical method yet devised for estimating intelligence development. Highly trained experts required to apply the tests accurately. Teachers, however, can greatly benefit by its use, although finest results cannot be expected. Cautions against using the scale "in part."

137. GODDARD, H. H.: *A Brief Report on Two Cases of Criminal Imbecility.*

J. of Psycho-Asthen. 1914, 19: 31-35.

These two cases (feeble-minded boys, both about 11 years mentally) "are probably epoch-making in that they are the first instances in judicial procedure in which so high a grade of mental defectiveness has been recognized by the court."

- (Discussion by E. J. Emerick, G. Wallace, A. C. Rogers, C. Bernstein, and W. E. Fernald.)
138. GODDARD, H. H.: *Who is Mentally Defective—How Many Are There—And How Can They Be Detected?*
Fourth Intern. Congr. on Sch. Hyg., Buffalo, 1913, Vol. V, pp. 621-626.
The use of the scale in helping solve the problems indicated.
 139. GODDARD, H. H.: *Tests of Intelligence*.
In Reference Handbook of the Medical Sciences, pp. 607-613.
An excellent summary of the scale, how it was derived, what it is, and how it is applied.
 140. GODDARD, H. H.: *Mental Deficiency*.
In Reference Handbook of the Medical Sciences, pp. 379-385.
The use of the scale for purposes of classification.
 141. GODDARD, H. H.: *Teachability of the Feeble-minded*.
J. of Psycho-Asthenics 1913, 18: 54-60.
The question of education in relation to mental age.
(Discussion by A. C. Rogers, W. E. Fernald, C. Bernstein.)
 142. GODDARD, H. H.: *The Binet Tests in Relation to Immigration*.
J. of Psycho-Asthenics. 1913, 18: 105-110.
The use of the scale increased nine-fold the efficiency of detecting feeble-mindedness at the Ellis Island immigration station.
(Discussion by W. E. Fernald, W. Healy, C. S. Berry, H. H. Goddard.)
 143. GODDARD, H. H.: *The Adaptation Board as a Measure of Intelligence*.
Training School Bull. 1915, 11: 182-188.
Correlation between mental age and ability in this test. Finds it very satisfactory as a test for age 8.
 144. GODDARD, H. H.: *A Course of Study for Teachers of Mental Defectives*.
School and Society, 1916, 3: 497-502.
Indicates that a course of training for teachers covering two years (2000 hours) should include the diagnosis of feeble-mindedness to which 100 or more hours, ought to be devoted.
 145. GODDARD, H. H.: "Schools and Classes for Exceptional Children."
J. Educ. Psychol. 1916, 7: 287-293.
A criticism of the report of David Mitchell for the Cleveland Foundation (See later reference.)
 146. GODDARD, H. H.: *Mentality Tests: A Symposium*. (Extracts from a personal letter to C. E. Seashore. See later reference.)
J. Educ. Psychol. 1916, 7: 231-233.
"Your symposium sounds like a good thing and undoubtedly it will be interesting reading, but I really do not look for any great unanimity until more people get down to solid work on the problem." Mentions Terman and Kuhlmann who have profited by all of Binet's work, and are now going on where he left off. "I use the Binet tests because they are so far the best that have been produced." "I have found from nearly ten years' living with the feeble-minded that Binet was correct in his theories of the feeble-minded and of their psychology, to a much greater extent than is given to most mortals."
 147. GODDARD, H. H.: *The Hygienic Value of Grading a School According to the Intelligence of the Pupils*.
Proc. Eighth Congr. Amer. Sch. Hyg. Assoc., San Francisco, 1915, Vol. V, pp. 157-162.
The importance of grading by mental age indicated.

MANUAL ACCURACY IN PREVOCATIONAL-SCHOOL BOYS

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The following is a summary of work done in one of the "Ettinger" prevocational schools of New York City, to determine by means of tests, whether any change in general manual accuracy, due to shop practice, can be discovered in boys taking the first year of the prevocational work. A two-year course is offered for the 7th and 8th grades, giving training in eleven of the trades, each of which requires a considerable degree of manual accuracy. During the first year a boy passes through three of the shops, spending three hours a day in that work.

The problem then was to discover if the effects of shop practice are transferred. The procedure adopted and carried out was to test at the beginning of the school year,—during the eleven school days from September 28 to October 14, 1915,—a large group of PV¹ boys, and a control group of A boys from the same grade. There were 96 subjects in each group. At the end of the year—from June 5 to 13, 1916—the same tests were repeated with the same boys. At that time there were remaining in the school 62 of the A and 61 of the PV subjects who had taken the tests. These only were considered in any of the results. In so far as the tests are a reliable index of manual accuracy, a comparison of the results of the two testings should indicate any change in ability.

It was required that the tests should be exclusively manual, not confined to small movements, and should be simple and quick in operation. Fifteen minutes per subject was about the time required. Three tests were used, the first called the Thrusting. In this test there passes at a constant speed past a slit in front of the subject, horizontal rows of capital O's, three O's in each row, and no row more than 11 cm. wide. One row only is in sight at a time. The position of each O relative to the others in the row, varies each time. The middle O of the three is always the target, which the subject endeavors to hit with a pencil, as the rows go past the slit. A set is composed of thirty rows. Four sets are presented to each subject, the first allowing each row to be in sight 2.0 sec., the next 1.6 sec., the next 1.2 sec., and the last, 1.0 sec. A perfect hit was scored six (6), a miss three

¹ PV refers in each case to the Prevocational group, and A refers to the Academic.

(3), a hit at a wrong O one (1) and the omission of a hit zero (0). The scores might thus range from zero, where not any hit was made, to 180, where every middle O was hit.

The second test was the Hammering. In this the task was to hit with a small hammer three points, one after another, at the rate of fifty blows in thirty seconds. The points were in a triangular circuit, mutually distant 51 cm. The average number of hits in two trials was the score used. The third test used was the Three-Hole test, quite commonly employed and sometimes known as a "Coördination" test. The measure used was the time taken for fifty contacts.

Table I gives the Median, Average, and Probable Error of the Average of the thrusting test scored on the basis mentioned above. It shows that there was practically no change in either group between the times when the two tests were made.

TABLE I.

Showing Scores in Thrusting Test for Both Groups at the Beginning and End of the Year

	Speed 2.0			Speed 1.6			Speed 1.2			Speed 1.0		
	Med.	Av.	P.E.	Med.	Av.	P.E.	Med.	Av.	P.E.	Med.	Av.	P.E.
Academic												
1915.....	120	120.5	11.5	113	117.6	13.4	111	112.1	7.9	105	103.4	10.6
1916.....	114	116.9	8.9	111	112.5	7.5	108	108.1	5.9	107	108	7.0
Prevocational												
1915.....	114	117.2	6.2	115	117	9	111	110	8	105	105	12
1916.....	116	115.9	10.1	115	113.1	6.9	111	110.8	5.8	105	106.5	7.5

Individual changes, to justify these figures, show the following facts, according as the subjects did better or worse at the end of the year:

Speed	Better		Equal		Worse	
	A	PV	A	PV	A	PV
2.0	26	28	4	3	32	30
1.6	24	21	1	3	37	37
1.2	23	29	2	3	37	29
1.0	39	32	2	1	21	28

Table II shows the results in number of hits of the hammering test. The PE's are here so large that the figures are not seriously considerable. However, taking them for what they are worth, they seem to show a serious decline in ability at the end of the year, and that the PV group is each time superior to the A.

TABLE II.

Showing Scores in Number of Hits in the Hammering Test for Both Groups, at the Beginning and End of the Year

	Academic			Prevocational		
	Med.	Av.	P.E.	Med.	Av.	P.E.
1915.....	4	4.7	1.7	6	6.3	2.8
1916.....	3	3.5	1.5	4	4.1	2.1

Considering individual changes, in the A group in 1916, 12 raised, 8 equalled and 28 lowered the records of 1915. In the PV group the corresponding figures are 16, 4 and 41 respectively. Not all of the subjects took this test.

Table III gives the scores in seconds of the three-hole test. In both groups there were altogether 87 subjects who took this test, and of these all except one did slower work in 1916 than in 1915.

TABLE III.

Showing Scores in Number of Seconds in the Three-Hole Test for Both Groups, at the Beginning and End of the Year

	Academic			Prevocational		
	Med.	Av.	P.E.	Med.	Av.	P.E.
1915.....	29	29.0	3.0	28.5	28.8	2.8
1916.....	36	37.1	3.1	37.5	37.9	3.9

CORRELATIONS

How much does a subject, relative to the others, resemble himself in the two testings? The correlations are as follows, according to the Spearman foot-rule method.

Thrusting

A 62 subjects. Average r of four speeds, 1915-1916, = .282
 PV 61 " " " " " " = .356

Hammering

A 47 subj. 1915-16, r = .541
 PV 61 " " " " r = .486

Three-Hole

38 subj. r = .606 PE .07
 48 " r = .689 PE .07

In the thrusting and hammering tests the correlations are low. In the three-hole test, however, we are justified in believing that while the performances vary in a definite and uniform way, the variations within the groups are reasonably constant, and the test is a fairly reliable index of ability.

In conclusion, we may say that as far as the tests involved go, there is no improvement in the manual accuracy of Prevocational School boys in work more or less different from the shop work, when the tests are made at the beginning and end of the school year.²

The question is at once raised as to the effects of the work of the school year on manual ability. The importance of work in that field, and the scarcity of literature in it, make further investigation highly to be desired.

² Individual detailed records in the tests mentioned are available, and the author will be glad to correspond with any persons who are further interested in the work.

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EDITORIALS

The committee of the American Psychological Association on the examination of recruits, consisting of Drs. Bingham, Goddard, Haines, Terman, Wells, Whipple and Yerkes, met at Vineland, N. J., May 28 to June 13, and considered in detail the contributions that psychologists might make to the efficiency of the new National Army. It was agreed that it would be desirable for the military authorities to pick out those men who on account of illiteracy or foreign birth were unable to read and write English, the intellectually subnormal, the potentially psychotic, and the intellectually superior. To this end tests of various sorts were proposed, and the committee adjourned for a fortnight to enable the individual members to try these tests out. On July 1 the committee reconvened and selected a series of ten tests for group examinations and twenty-one tests to be used in various combinations for individual examinations. The group tests included a "following directions" test, immediate memory for digits, dissected sentences, arithmetical problems, range of information, opposites, selective judgment, sequence of numbers, logical relations, and a discrimination test. The entire series required fifty minutes

to give. The individual tests included the cube construction, clock test, Knox cube imitation, Porteus maze, Dearborn form board, orientational information, uncontrolled association, repeating digits backward, vocabulary, letter lines, dissected sentences, absurdities, controlled association (rimes), likenesses and differences, ingenuity, reproduction of designs, logical memory, comprehension, sentence construction, arithmetical reasoning, and code learning.

Arrangements were then made to give these tests an extensive application in four military camps, the Syracuse Reorganization Camp for regulars, the Fort Benjamin Harrison Camp for the officers' training reserve, the camp at Nashville, Tenn., for state troops, and the Brooklyn Naval Receiving Station for naval recruits. Between three and four thousand group test records were secured and forwarded to a central statistical bureau for scoring, and several hundred individual tests were made. On August 15 a meeting was called at Columbia University to hear a preliminary report of the statistical committee, to consider the reports of the psychological examiners who conducted the tests in the different camps, and to make such revisions and modifications of the tests as seemed desirable. In some of the camps in addition to the tests judgments were secured from officers as to the military efficiency of the men. Each man's name was written on a card and each officer was asked to sort the cards of the men in his company into five piles corresponding to the judgments "very good," "good," "fair," "poor," "very poor." Names with which the officer was not familiar were disregarded. In this way from one to three independent judgments were secured on each man. It is believed that the correlation between these judgments and the results of the tests will be fairly high. It must be remembered, however, that the tests are strictly intelligence tests, while the judgments of the officers may be based on physical appearance, docility, or some other criterion.

In general the attitude of the officers was that of interested curiosity, which frequently changed to hearty approval when pains were taken to explain the ultimate objects of the tests and the probability of a satisfactory selection. The men, throughout, took the tests seriously, and so far as one could determine did their best. So favorable has been the general impression produced by these preliminary tests that the War Department has decided to give the plan a systematic trial in six camps, and commissions have been issued to a number of psychologists to superintend the work.

J. C. B.

NOTES AND NEWS

One phase of Mr. Herbert Hoover's food conservation program is a carefully planned educational campaign to let the people know the exact needs of the country and the manner in which these needs must be met. To get this information into every home it is proposed to utilize the schools. A department of elementary and secondary education has been organized, and a conference of superintendents has been called in Washington to aid in this work. Arrangements have been made to keep the educational press informed as to the status of the work, and in this way it is hoped to enlist the active coöperation of teachers.

Former and present graduate students of the Department of Psychology of Cornell University and a number of his more intimate friends among the faculty met with Professor E. B. Titchener in the Psychological Laboratory on the evening of June 22, to celebrate the completion of twenty-five years of his service to Cornell.

A volume of Studies in Psychology, edited by Professors W. B. Pillsbury, J. W. Baird, and M. F. Washburn, and published by L. N. Wilson at Worcester, Mass., was presented to him on the occasion. The book contains the following papers: E. C. Sanford, *A Letter to Dr. Titchener*; M. F. Washburn, *The Social Psychology of Man and the Lower Animals*; W. B. Pillsbury, *Principles of Explanation in Psychology*; C. G. Shaw, *The Content of Religion and Psychological Analysis*; J. W. Baird, *Memory for Absolute Pitch*; R. M. Ogden, *Some Experiments on the Consciousness of Meaning*; R. H. Gault, *The Sense of Social Unity: A Problem in Social Psychology*; H. C. Stevens, *A Revision of the Rossolimo Tests*; L. R. Geissler, *The Affective Tone of Color-Combinations*; H. M. Clarke, *A Note on Recognition*; H. P. Weld, *Meaning and Process as Distinguished by the Reaction Method*; A. S. Edwards, *The Distribution of Time in Learning Small Amounts of Material*; K. M. Dallenbach, *The Psychology of Blindfold Chess*; C. A. Ruckmich, *Visual Rhythm*; L. D. and E. G. Boring, *Temporal Judgments after Sleep*; C. E. Ferree and G. Rand, *The Selectiveness of the Eye's Achromatic Response to Wave-Length and Its Change with Change of Intensity of Light*; J. N. Curtis, *Tactual Discrimination and Susceptibility to the Muller-Lyer Illusion Tested by the Method of Single Stimulation*; W. S. Foster, *A Bibliography of the Published Writings of Edward Bradford Titchener*.

After the presentation, Professor Titchener responded with some reminiscences of the early days of the Cornell Laboratory, and in conclusion announced that he had declined acceptance of the chair of psychology recently tendered him by Harvard University.

The Bureau of Publications of Teachers College, Columbia University, has recently purchased from the City of Boston the complete supply of the *Report of a Study of Certain Phases of the Public School System of Boston, Mass.*

The new Iowa child research station, established by an enactment of the last legislature, has been organized by the appointment of an advisory board of seven members, under the chairmanship of Professor C. E. Seashore, professor of psychology and dean of the graduate college. The board contains representatives from the college of medicine, the college of dentistry, the department of education, the extension division, the department of home economics, and the department of sociology. Professor Seashore spent the summer at the University of California, lecturing on psychology and on the application of tests for the determination of musical ability in school pupils.

A department of psychology is to be organized at the University of Minnesota. Doctor Robert M. Yerkes has been called from Harvard University to the Chairmanship of the Department. The staff, so far as announced, consists of Professor Yerkes, Associate Professor Herbert H. Woodrow, Assistant Professor Henry T. Moore, Assistant Professor Joseph Peterson, and Instructor K. S. Lashley. The permanent organization of the department may be somewhat delayed by the fact that Professor Yerkes has accepted a commission in the United States army, to direct the development and administration of mental tests in connection with the new National Army recently raised by the draft.

At the Carnegie Institute of Technology Professor W. D. Scott will continue as director of the Bureau of Salesmanship Research throughout the year instead of returning to Northwestern for the first semester as originally planned. Professor G. M. Whipple will have charge of certain phases of the work in mental tests during the first semester, having been granted leave of absence from the University of Illinois. L. L. Thurstone has been promoted to an in-

structorship in psychology, Beardsley Ruml (Ph. D., Chicago) has been made instructor in psychology, and A. J. Beatty (Ph. D., Illinois) has been appointed research assistant in the Bureau of Salesmanship Research. These, with Professors J. B. Miner, Kate Gordon, Edwin A. Lee and W. V. Bingham, Chairman, will constitute the faculty of the Division of Applied Psychology for the coming year.

Mr. H. A. Brown, director of the Bureau of Research, New Hampshire Department of Public Instruction, has been elected president of the Wisconsin State Normal School, at Oshkosh, Wisconsin.

Dr. Frederick Stephen Breed, of the University of Michigan, has been appointed assistant professor of education at the University of Chicago.—*School and Society*.

Dr. Frank Nugent Freeman has been promoted from assistant professor to associate professor of education in the University of Chicago.

At Dartmouth College Charles L. Stone has been appointed instructor in psychology.

At Oberlin College Dr. Edward S. Jones, of Northwestern University, has been appointed assistant professor of psychology; Jacob Speelman, director of athletics at Lawrence College, Appleton, Wis., assistant professor of physical education; and Dr. Carl C. W. Nichol, assistant professor of psychology, acting dean of college men.—*School and Society*.

At the University of Oklahoma H. E. Cunningham, president of Lebanon University, has been elected assistant professor of education.—*School and Society*.

Mr. E. A. Doll, assistant psychologist at the Vineland Training School for Feeble-minded, has accepted a position in the department of psychology at Princeton University.

Mr. Arthur S. Otis, of the graduate department of Stanford University, has been appointed assistant psychologist in the Training School, at Vineland, N. J.

PUBLICATIONS RECEIVED

BIRD T. BALDWIN. *A Study in Mental Retardation in Relation to Etiology*. Reprinted from the Medical Record, January 27, 1917. Pp. 21.

This is a detailed study of a child who suffered a severe attack of cerebro-spinal meningitis in infancy, and who at the age of sixteen is well developed physically but greatly retarded mentally. The author gives a succinct account of the educational efforts that have been made with the boy and the resulting intellectual improvement.

FRANK W. BALLOU. *Arithmetic. Determining the Achievement of Pupils in the Addition of Fractions*. Bulletin Number 7, Department of Educational Investigation and Measurement. Boston Public Schools, 1916. Pp. 28.

Although arithmetic was the first school subject in which scientific measurements were attempted, practically nothing has been done in that subject outside of fundamental combinations of integers. This is the first scientific study of ability to deal with fractions. The bulletin describes the construction of the tests, the plan of the testing, and the significant results. Approximately 1200 pupils were tested in each of Grades VI, VII, and VIII. The author finds that the factors which enter into the problem of adding fractions are much more complex than those involved in the addition of integers. The chief errors occurred in the reduction of fractions to lowest terms or to mixed numbers. The author thinks that the present method of teaching reduction is unsatisfactory and believes that it should be taught in direct connection with addition of fractions. Eight per cent. in Grade VI, eleven per cent. in Grade VII, and five per cent. in Grade VIII, were unable to solve the simplest problems in the addition of fractions.

LEE EMERSON BASSETT. *A Handbook of Oral Reading*. Boston: Houghton Mifflin Company, 1917. Pp. vii, 353.

The central idea of this handbook is that expression is concerned primarily with ideas. Technical drill on vocal exercises, enunciation, and pronunciation are, therefore, put at the end of the book rather than at the beginning. Clear understanding rather than emotional exaggeration is the basis of effective and convincing speech. Part I is devoted to thought getting, and to the voice modulations which indicate well ordered thinking and arouse such thinking in others. The most important factors in thought expression are grouping, by means of pauses and changes of pitch, inflection and pitch variation, and emphasis. Part II deals with imaginative portraiture and the awakening of emotional response. Part III considers the technical aspects of voice production, voice training, enunciation and pronunciation. The book contains a large number of carefully chosen exercises.

KONRAD BERCOVICI. *Crimes of Charity*. New York: Alfred A. Knopf, 1917. Pp. 270. \$1.50.

The author presents in easy conversational narrative the first-hand experiences of a worker in organized charity. He firmly believes that organized charity is a great curse hovering like a vampire over its victims and sucking out their life blood of independence, self-respect and honesty. The picture of the ruin wrought by organized charity is a most doleful one, and a part of the tale's tragedy is the fact that the incidents are narrated in such a simple, straightforward fashion that the reader gains the conviction that the incidents may well be quite authentic. It is not that the administrators of organized charity are inhuman beings by nature, but the evil system of which they are the agents debases and demoralizes them until their activities reveal an almost fiendish automatism. Unfortunately the author's attitude is entirely destructive, and he has nothing constructive to offer in place of the institution which he arraigns.

W. V. BINGHAM. *Mentality Testing of College Students*. Reprinted from the Journal of Applied Psychology. Vol. I, 1917. Pp. 38, 45.

The author comments on the growing demand for mental tests in college work and advocates the encouragement of new tests, the better standardization of old tests, and the carrying on of coöperative research.

PAUL BJERRE. *The History and Practice of Psychoanalysis*. Translated by Elizabeth N. Barrow. Boston: Richard G. Badger, 1917. Pp. 294. \$3.00.

This is an extremely interesting book, tracing the development of psychoanalysis from Kant and Feuchtersleben to the present day. The book presents a lively account of Wetterstrand and the Nancy school of hypnotism, Freud and the Vienna movement, the Adler doctrine and the deserters from the Freud camp, the nature of hypnotism, the warfare between the advocates of the conscious and the unconscious, the history of an interesting case, and the present outlook of psychology. The author takes issue with the dictum of Bernheim, "There is no hypnosis, there is only suggestion," and considers that there is a distinct place for hypnotic-therapy. Hypnosis is defined as a temporary sinking back into that primary state of rest which obtained during fetal life.

EMILE BOIRAC. *L'Avenir des Sciences Psychiques*. Paris: Librairie Felix Alcan, 1917. Pp. 300. 5 francs.

This book deals not with psychology as an experimental laboratory science, as pursued in this country, but with such phenomena as are detailed in the reports of the Society for Psychic Research—with hypnotism, animal magnetism, thought transference, clair-

voyance, and spiritualism. To ask in solemn fashion to the extent of 300 pages whether it is possible for such extravaganzas to become scientific would seem to be designed either to arouse Homeric laughter or to make one weep at the credulity of human nature. The value of the book lies in the minute and painstaking account of the present status of these pseudo-psychological cults. We turn from the book with the conviction that the French mind moves in devious and incomprehensible channels when the subject of psychology is under discussion.

J. CROSBY CHAPMAN AND GRACE PREYER RUSH. *The Scientific Measurement of Classroom Products*. Boston: Silver, Burdett and Company, 1917. Pp. viii, 191.

The volume presents in brief compass some of the more important attempts at devising and applying educational measurements. In Chapter I, the authors compare the various subjective scales used by teachers in estimating the value of school work, such as the 100 per cent. scale, the A, B, C, D, scale, the good-fair-poor scale, etc., with the objective scales which have recently been proposed. Chapter II deals with arithmetic scales, and describes the Courtis Standard Tests, Series A and Series B, and the Woody Arithmetic Scale. In Chapter III (handwriting scales) the Thorndike and the Ayres Scales are reproduce in detail, and the Courtis method of securing samples is described. Chapter IV, on reading scales, gives the Thorndike, the Gray, and the Starch tests, and the Courtis method of scoring reading. Chapter V is devoted to spelling scales, with Buckingham, Starch, and Ayres as representatives. Why the Buckingham word lists are given without their corresponding absolute values is difficult to understand. Chapter VI reproduces the Hillegas Composition Scale entire and the description scale as representative of the Harvard-Newton scales. It is interesting to note that Chapter VII is devoted entirely to the Trabue Completion Test Language Scales, although no norms or standard scores are presented. In Chapter VIII several samples of Thorndike's Drawing Scale are reproduced, though no reference is made to Childs' application of this scale to the drawings of school children. The final chapters, IX and X, deal with the applications of the tests in schools and with certain dangers which should be guarded against in the use of educational scales. An appendix presents a very brief bibliography.

WALTER LIBBY. *An Introduction to the History of Science*. Boston: Houghton Mifflin Company, 1917. Pp. x, 288. \$1.50.

"The history of science has something to offer to the humblest intelligence. It is only by teaching the sciences in their historical development that the schools can be true to the two principles of modern education, that the sciences should occupy the foremost place in the curriculum, and that the individual mind in its evolution should rehearse the history of civilization. This book is intended as a simple introduction, taking advantage of the interests of youths

from seventeen to twenty-two years of age in order to direct their attention to the story of the development of the sciences. It is therefore a psychological introduction, having the mental capacity of a certain class of readers always in view, rather than a logical introduction, which would presuppose in all readers both full maturity of intellect and considerable initial interest in the history of science." The book is written in fascinating style and is to be heartily commended for use in high schools and colleges. Each chapter is followed by a selected bibliography.

CHRISTABEL M. MEREDITH. *The Educational Bearings of Modern Psychology*. Boston: Houghton Mifflin Company, 1917. Pp. 143. Sixty cents.

This is a book on instinct and habit in their relation to education. The author is an English writer and holds to the conception of instinct made familiar by the social psychology of McDougall. Instincts are presented as definite entities which ripen at different times and either disappear or are modified into habits. It is a pity that the concept of instinct has secured such a hold upon educational psychology. It is a purely metaphysical creation, with at best a tenuous factual basis, and on this account it lends itself beautifully to psychological and educational theorizing. Actual analysis of behavior, however, as Thorndike has shown, reveals a degree of complexity that leaves no dividing line between instinct and habit. All behavior of whatever sort goes back to the basis of inherited nervous structure, while there is no phase of school behavior that has not been profoundly modified by habit formation. To recent experimental studies with mental tests or to the development of educational measurements the book contains not a single reference.

RUDOLF PINTNER AND DONALD G. PATERSON. *A Scale of Performance Tests*. New York: D. Appleton and Company, 1917. Pp. x, 218. \$2.00.

This attractive and well constructed book brings together widely scattered material, and presents the results of original investigations on a new aspect of the study of intelligence. The Binet-Simon tests and other information tests have attracted a great deal of attention and have been of great service in indicating mental defect or superiority. But, as Ayres and others have insisted, these tests do not take sufficient account of those who are able to *do* things rather than to *talk about* them. The authors here present fifteen performance tests. The methods used in standardizing these and the data derived from their application to children from the ages of four to sixteen are given in detail. From these data the authors construct a scale similar in some respects to the Binet scale. This is followed by chapters on the median mental age, the Yerkes-Bridges Point Scale, and tables giving the percentile distributions of the scores in each test. It is to be hoped that the book will stimulate interest in and the use of these tests with children of normal and superior mental ability.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

THE POWER OF THE EYE TO SUSTAIN CLEAR SEEING UNDER DIFFERENT CONDITIONS OF LIGHTING

C. E. FERREE AND GERTRUDE RAND

Bryn Mawr College

The work of which this paper is a brief outline was done under the auspices of the American Medical Association and has been in progress for six years. The object of the work has been to compare the effect of different lighting conditions on the eye and to find the factors in a given lighting situation which cause the eye to lose in efficiency and to experience discomfort.

Confronting the problem of the effect of different lighting conditions on the eye, it is obvious that the first step towards systematic work is to obtain some means of estimating effect. The prominent effects of bad lighting systems are loss of efficiency, temporary and progressive, and eye discomfort. Three classes of effect, however, may be investigated: (1) the effect on the general level or scale of efficiency of the fresh eye; (2) loss of efficiency as the result of a period of work; and (3) the tendency to produce discomfort. A description of tests designed especially for the investigation of these effects has already appeared in print.¹ Some of these tests have been designed to determine the eye's aggregate drop in functional power, others to aid in the analysis of this effect. Space can be taken here for the mention of only one, namely, the one with which the results presented in this paper were obtained. Just two principles are involved in this test. One is that visual acuity or clearness of seeing may be measured by the smallest angle the eye is able to discriminate; the other, a principle equally old, is that a loss of efficiency in a machine, apparatus, or a living organ or organ-

¹ Transactions of the Illuminating Engineering Society, 1913, VIII, pp. 40-60; 1915, X, pp. 1122-1170; Annals of Ophthalmology, July, 1916, pp. 1-3.

ism will show out more plainly when a prolonged rather than a momentary performance is required. These principles in their simplest terms have been combined into a test of the comparative ability of the eye to maintain its power of clear seeing or aggregate functional activity under different conditions of lighting and under different kinds and conditions of use. In operation the test method may be described briefly as follows: The power of the eye to sustain a certain standard of acuity for three minutes is measured before and after a period of reading from uniform type and paper under the lighting conditions to be tested. That is, by means of a visual acuity test-object with the appropriate auxiliary apparatus for its manipulation, and a kymograph and chronograph, records are made of the time the eye can be held up to this standard of performance and the time it drops below. The ratio of these two quantities to each other, or to the total time for which the record is made (3 minutes) is taken as the measure of the ability of the eye to sustain its power of clear seeing before and after the task that is set for it under the lighting conditions to be tested. In the charts appended this ratio is plotted against the time of exposure of the eye to the conditions to be tested to show the relative drop in power to sustain clear seeing under these conditions.

The following aspects of lighting sustain an important relation to the eye: the evenness of illumination, the diffuseness of light, the angle at which the light falls on the object viewed, the evenness of surface brightness, the intensity, and the composition or color value. The first four of these factors, which may be grouped together as distribution factors, will be discussed briefly with reference to types of lighting now in common use.

The ideal condition with regard to the distribution factors, so far as the functional welfare of the eye is concerned, is to have the field of vision uniformly illuminated with light well diffused and no extremes of surface brightness. When this condition is attained the illumination of the retina will shade off more or less gradually from center to periphery, which gradation is necessary for accurate and comfortable fixation and accommodation. In the proper illumination of a room by daylight, we have been able thus far to get the best control of the distribution factors. Before it reaches our windows or skylights, daylight has been well diffused by innumerable re-

flections; and the windows and skylights themselves, acting as sources, have a broad area and low intrinsic brilliancy, all of which features contribute towards giving the ideal conditions of distribution stated above. Of the systems of artificial lighting the best control of the distribution factors, speaking in general terms, is given by the indirect systems, and the semi-indirect systems in which a small portion of the light is direct. In the indirect systems the source is concealed from the eye and the light is thrown against the ceiling or some other diffusely reflecting surface in such a way that it undergoes one or more reflections before it reaches the eye. When properly installed the use of these reflectors introduces no extremes of surface brightness into the field of view greater than that which the eye is prepared to stand without a significant depression of functional power. Moreover, the brightest spots are on the ceiling and are, therefore, in rooms of ordinary height pretty well removed from the zone of most harmful influence on the eye. The direct lighting systems are designed to send the light directly to the plane of work. In the use of these systems there is in general a tendency to concentrate the light on the working plane or object viewed rather than to scatter it in all directions, and therefore a tendency, especially with some types of reflector and kinds of installation, to create brightness differences in the field of vision rather than to level them down. Much can be done to ameliorate this tendency, however, in constructing the reflector and grading its density and in choosing the height of installation above the working plane. Too often, moreover, the eye is not properly shielded from the light source and frequently no effort at all is made to do this, although such neglect is strongly condemned by the more advanced lighting engineers. In fact, how to retain as much as possible of the superior physical efficiency of direct lighting and at the same time to protect the eye from the harmful effects of badly controlled distribution factors more especially from the glare of poorly concealed sources, from the excessive brilliancy presented by the surfaces of reflectors of low density and by the openings of reflectors of high density, etc., is one of the most interesting and difficult problems presented to the workers in this field at the present time. The semi-indirect reflectors are intended to represent a compromise between the direct and indirect reflectors. A part of the light is transmitted

to the plane of work through the translucent reflector placed directly beneath the source of light and a part is reflected to the ceiling. Thus depending on the density of the reflector, this type of lighting may vary between the totally direct and the totally indirect and share in the respective merits and demerits of each in proportion to its place in the scale. By giving a better control of what we have called the distribution factors this type of lighting is supposed also, to be a concession to the welfare and comfort of the eye, and so it is in reflectors of high density. Our tests, however, show that the concession is not nearly so great as it was supposed to be in reflectors of low and medium density. In fact, when installed at an intensity of illumination ordinarily used or at an intensity great enough for all kinds of work, little advantage seems to be gained for the eye in this type of lighting with reflectors of low and medium density; for with these intensities of light and densities of reflector, the brightness of the source has not been sufficiently reduced to give much relief to the suffering eye. Moreover, the principles in accord with which the installation is made require that the reflector be brought further into the field of view than is the case, for example, when a direct reflector is used, installed, as is the custom, on the ceiling or as near to it as possible. On this account, therefore, even a worse result is apt to be obtained with semi-indirect reflectors of low and medium density than with equally well designed and well installed direct reflectors of the same density.

In the selection and use of observers for the work the following are some of the precautions that were taken. Care was exercised, in the first place, to choose only those who had already attained a satisfactory degree of precision in other work in physiological optics and whose clinic record showed no uncorrected defects of consequence. All were under 30 years of age. Moreover, before being allowed to take part in the actual work of testing, each observer was trained to a satisfactory degree of precision in the three-minute record under a given lighting condition, and in the three-hour test under several of the conditions to be tested. In the actual work of testing the results were compiled from a number of observations and the precision was checked up by size of the mean variation. No results were accepted as significant unless the variation produced by chang-

ing the conditions to be tested was largely in excess of the mean variation, or mean error, for each condition tested. This, the accepted conventional check on the influence of variable extraneous factors, was carefully applied at each step in the work.

The investigations have not been abstract in character. All the conditions tested were actual lighting situations produced by employing installations in common use.² In order that a correlation might be made between lighting conditions and the effect on the eye, the following specification of illumination effects was made in each case. (1) A determination was made of the average illumination of the room under each of the installations of lighting used. The room was laid out in 3 ft. squares and illumination measurements were made at 66 of the intersections of the sides of these squares and at the point of work. The photometric readings were taken in a plane 122 cm. above the floor with the receiving plate of the illuminometer in the horizontal, the vertical and the 45 deg. positions, measuring respectively the vertical, the horizontal and the 45 deg. components of illumination. The 122 cm. plane was chosen because that was the height of the test-object. In the work on the distribution series the illumination for each of the conditions tested was made as nearly as possible equal at the point of work. (2) A determination of the brightness of prominent objects in the room, such as the test surface, the reflectors for the semi-indirect installation, reflectors and filament for the direct installation, the reading page, the specular reflection from surfaces, etc., was made in candle-power per square inch. The brightness measurements were made by means of a Sharp-Millar illuminometer with the receiving test-plate removed. The instrument was calibrated against a magnesium oxide surface obtained by depositing the oxide from the burning metal on a white card. By this method the reflecting surfaces were used as detached test-plates. The readings were converted into candle-power per sq. in. by the following formula:
$$\text{Brightness} = \frac{\text{Foot-candles.}}{\pi \times 144}$$

² In all fifty-two different lighting situations have been tested. In addition, miscellaneous experiments have been conducted on the effects of different types of eye shade, the angle at which the light falls on the work, the fatigue of the fixation muscles under different types of lighting, the effect of motion pictures on the eye, etc.

(3) Photographs were made of the room from three positions under each system of illumination.³

In the tests for the effect on the eye the following results were obtained: (1) Of the lighting factors that influence the welfare of the eye those that we have grouped under the heading of distribution are apparently fundamental. They seem to be the most important we have yet to deal with in our search for the conditions that give us the minimum loss of efficiency and the maximum comfort in seeing. If, for example, the light is well distributed in the field of vision and diffuse, and there are no extremes of surface brightness, our tests indicate that the eye, so far as the ranges that are apt to be encountered in the work of lighting are concerned, is practically independent of intensity. That is, when the proper control is had of the distribution factors, intensities high enough to give the maximum discrimination of detail may be employed without causing appreciable damage or discomfort to the eye.

(2) For the type of control of distribution effects given by the semi-indirect reflectors of low and medium density, and the direct reflectors presenting an excessive brilliancy due to opening, surface of reflector, or wholly or partly exposed source, our results show unquestionably, that too much light is being used in ordinary work for the comfort and welfare of the eye. That is, with these reflectors means have not yet been found to produce this amount of light without introducing harmful brilliancies into the field of vision.

(3) The angle at which the light falls on the object viewed is an important factor, but not nearly so important, for example, as evenness of surface brightness in the field of vision. Extremes of surface brightness in the field of vision seem to be the most important causes of the eye's discomfort and loss of efficiency in lighting systems as we have them at the present time. In lighting from exposed sources it is not infrequent to find the brightest surface from 1,000,000 to 2,500,000 times as brilliant as the darkest; and from 300,000 to 600,000 times as brilliant as the reading page. These extremes of brightness in the field of vision are, our tests show, very fatiguing to the eye.

³ For a full specification of the illumination effects, illumination and brightness measurements, brightness ratios, photographs of room, etc., for all the work that has been done up to this time, see Transactions of the Illuminating Engineering Society, 1913, VIII, pp. 40-60; 1915, X, pp. 407-447, 448-502, 1097-1130.

(4) Of the systems of artificial lighting tested thus far, the best results have been obtained from the indirect systems, and from the semi-indirect systems with reflectors having a high density. By means of these reflectors the light is well distributed in the field of view, and extremes of surface brilliancy are kept within the limits which the eyes are prepared to stand. A great deal of loss of visual efficiency has been found to result, however, from the use of semi-indirect reflectors of low and medium density and from direct reflectors of medium and shallow depth. With regard to the degree of density that is most favorable for the eye, the direct reflectors, we may point out, seem to present a special case. That is, with reflectors of medium depth our best results have been gotten so far with reflectors of medium density. This, however, is not in contradiction to our general principle that extremes of brightness are fatiguing to the eye, as one might at first suppose. For, as a general case, the denser the reflector, the greater is the brightness of the opening. That is, if the physical efficiency of the reflector is not to be lowered by increasing its density, the opening must become brighter in some proportion to the increase of density; for, in a totally opaque reflector all and in the denser reflectors nearly all of the light illuminating the room, as well as that sent directly to the working plane, must come from the opening of the reflector. Moreover, in case of the denser reflectors, the ceiling and the reflectors themselves are dark, while standing out in sharp contrast to them, is the bright opening of the reflector. In the reflectors of medium density, on the other hand, the opening need not have such a high brilliancy and there is little contrast between it and its surroundings. When installed on or near the ceiling in rooms of moderate height, the best results seem to be obtained when the opening, the surface of the reflector, and the ceiling have as nearly as possible an equal brilliancy. It seems probable that the effect on the eye of the denser reflectors can be very much improved by increasing the depth of the reflector and by other devices that will lower the brilliancy of the opening. These devices will be discussed in later work. It will be sufficient here to state that by means of them we have been able to lower the brilliancy of the opening of opaque reflectors of the deep bowl type by amounts that give very good results for the eye without causing a prohibitive loss in the amount of light delivered to the room.

(5) The problem of installing is not the same for the semi-indirect as for the totally indirect reflector. In the latter case the height should be so adjusted as to give as nearly as possible an even distribution of surface brightness, and a uniform illumination on the working plane. In the case of the semi-indirect reflectors, especially those of low and medium densities and in rooms of the height usually found in dwelling houses, if the distance from the ceiling is made great enough to produce these effects, the bright reflectors are dropped too low in the field of view for the maximum comfort and efficiency of the eye. Apparently the denser they are, the more nearly they can afford to be installed as indirect reflectors; and the less dense they are the more nearly they should be installed as direct reflectors—so far as effects on the eye of the kind revealed by our tests are concerned. In this connection, it may be called to mind that in current practice, direct reflectors for general illumination are usually installed on the ceiling or as near to it as possible, especially in rooms low or medium in height.

(6) In the work of providing general illumination, the most difficult feature presented in the problem of protecting the eye is encountered in the lighting of rooms of low or medium height. The difficulty decreases with increase in the height of the ceiling. In rooms whose ceilings are very high in proportion to the other dimensions of the room, it seems safe to say that comparatively good results should be gotten with almost any reflector of modern design; for it is much easier in such rooms to get the bright sources of light, primary and secondary, out of the zone of most harmful influence on the eye.

(7) The loss of efficiency sustained by the eye in an unfavorable lighting situation seems to be muscular, not retinal. The retina has been found to lose little, if any, more in efficiency under one than another of the lighting systems employed (tested by power to discriminate color and brightness, rate of exhaustion and rate of recovery, after as many as ten hours of work under the lighting system in question).

(8) In all of the conditions tested a rather close correlation is found to obtain between the tendency of a given lighting condition to cause loss of visual efficiency and to produce ocular discomfort. The tendency to produce ocular discomfort was estimated by the time required for just noticeable discomfort

to be set up with the eye working and at rest under the conditions to be tested. The results of this work were also carefully checked up by the determination of the mean variation.

CONDITIONS TESTED

The tests throughout the work were conducted in a room 30.5 ft. long, 22.2 ft. wide and 9.5 ft. high. In Fig. 1 this room is shown drawn to scale: North, South, East and West Elevations, and Plan of Room. In the Plan of Room are shown by a cross and the appropriate numeral, the 66 stations at which the illumination measurements were made; also the positions of the outlets A, B, C, D, E, F, G and H for the lighting fixtures. In the drawing, East Elevation, one of the positions at which the tests were taken is represented, namely, the one with six reflectors in the field of view. The walls and ceilings of this room are of rough plaster painted a mat white. The floor is of medium dark tiling.

In our choice of the first set of conditions to be tested it was our purpose to make a selection that would give a wide variation in the distribution factors. Three types of lighting were chosen. One may be called an indirect system; one a direct system; and

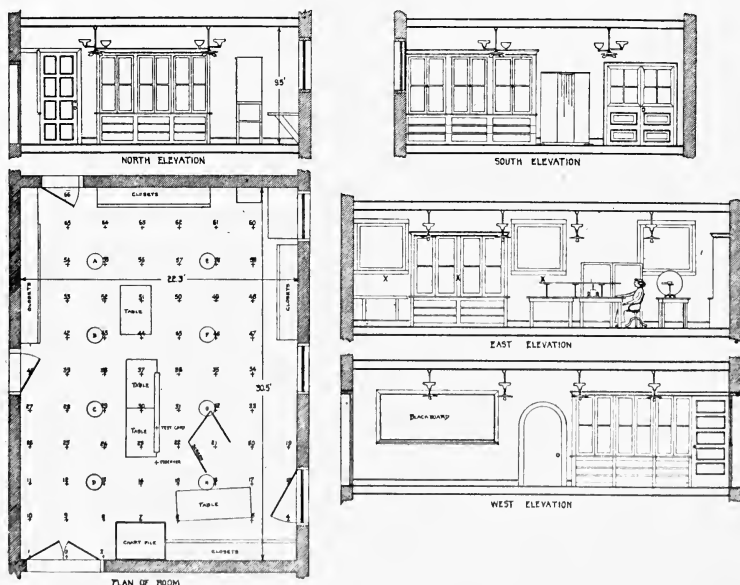


FIGURE I

one a semi-indirect system. The direct reflectors were not of the most modern make although they may be said to give effects very similar to much of the lighting in actual use at the present time. They were of porcelain ware 16 inches in diameter and only slightly concaved. When placed above the lamps employed, they served merely to distribute the light to the working plane. No protection from the brilliancy of the light source was afforded to the eye. For the semi-indirect system inverted alba reflectors 11 inches in diameter were employed. These reflectors are of modern design and represent very well glassware of medium density. In case of the indirect system corrugated mirror reflectors were used inclosed in brass bowls. These reflectors are also of modern design and give effects which may be taken to represent very well those obtained in good indirect lighting. The tests were taken at four positions in the room,—one with six, one with four, one with two, and one with none of the lighting units in the field of view. The last three of these positions are marked with a cross in Fig. 1, East Elevation. A graphic representation of the results of the tests for the four positions is given in Chart 1. Because of the amount of space that it would require, a tabular statement of results will not be given in this paper.

In the second series of experiments we undertook to determine the most favorable intensities of illumination for the three types of installations we had used in the first series; and in addition the effect of varying the intensity of the illumination with the particular grouping of distribution factors represented in each case. The tests were made in the same room, with the same fixtures, and in general with the same conditions of installation and methods of working as were described in the account of the experiments of the first series. To secure the various degrees of intensity of light needed, lamps of different wattages were employed. In order to keep the distribution factors as nearly constant as possible for a given type of system, the lamps used in making the tests for that type of system were all of one wattage, *i. e.*, were all 15's, 25's, 40's, 60's, or 100's. For the indirect and semi-indirect systems 25, 40, 60, and 100 watt lamps were employed. Our fixtures for the direct system were so installed that either one or two lamps could be used in each fixture, totaling respectively 8 and 16. In order to get a wider range of

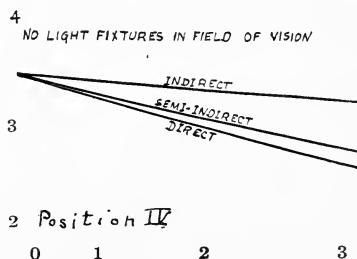
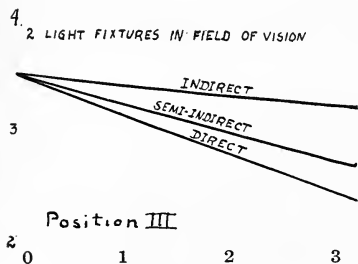
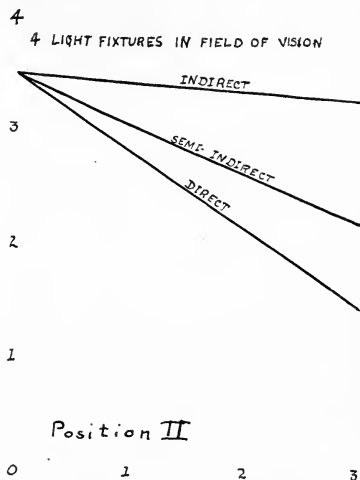
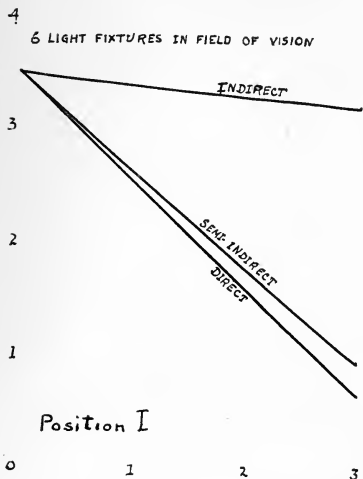


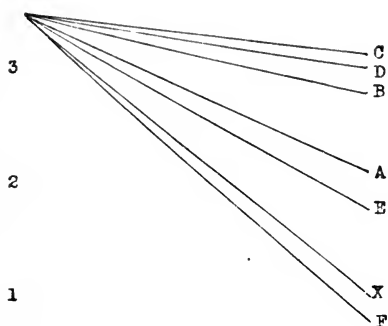
CHART I.

Showing the tendency of the three types of reflector, direct, semi-indirect and indirect, to cause loss of visual efficiency or power to sustain clear seeing; also the effect of varying the observer's position in the room or the number of bright sources, primary and secondary, in the field of view.

intensities both numbers of lamps were used, *i. e.*, one series of tests was made with 8 lamps, and another with 16. Also four intensities of light were employed in each case. These intensities were secured in the 8-lamp system by using lamps totalling 120, 365, 400 and 800 watts. In case of the semi-indirect and indirect reflectors socket extenders had to be used with the 25- and 40-watt lamps. That is, without these extenders these lamps, on account of their smaller size, came so low in the reflectors as to change the distribution effects given by them. For example, without the socket extenders with

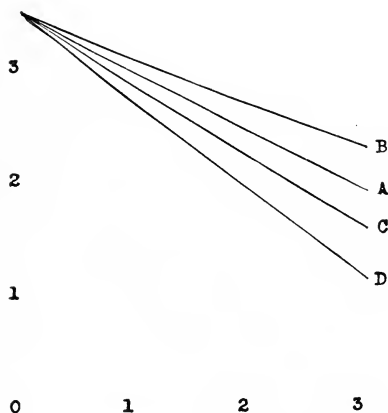
Lighting system: Semi-indirect					
Watts	Volts	Foot-candles			
		Vertical	Horizontal	45°	
A..200	107	1.6	0.45	1.15	
B..200	110	1.72	0.484	1.29	
C..320	107	2.2	0.58	1.52	
D..320	110	2.31	0.62	1.61	
E..480	107	3.3	0.94	2.4	
F..800	107	6.8	1.82	4.5	
X..760	107	5.8	1.45	4.0	

4



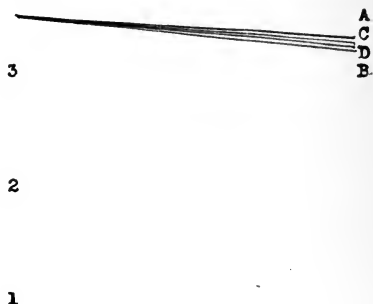
Lighting system: Direct (8 lamps)					
Watts	Volts	Foot-candles			
		Vertical	Horizontal	45°	
A..120	107	0.64	0.32	0.49	
B..200	107	1.16	0.45	0.85	
C..320	107	1.97	0.65	1.39	
D..480	107	2.6	1.02	2.0	

4



Lighting system: Indirect					
Watts	Volts	Foot-candles			
		Vertical	Horizontal	45°	
A..200	107	1.33	0.39	0.87	
B..320	107	1.7	0.49	1.08	
C..480	107	3.0	0.765	1.97	
D..800	107	5.2	1.36	3.5	

4



Lighting system: Direct (16 lamps)					
Watts	Volts	Foot-candles			
		Vertical	Horizontal	45°	
A..240	107	1.23	0.54	0.935	
B..365	107	1.6	0.6	1.33	
C..400	107	1.86	0.8	1.46	
X..880	107	4.2	1.41	2.6	

4

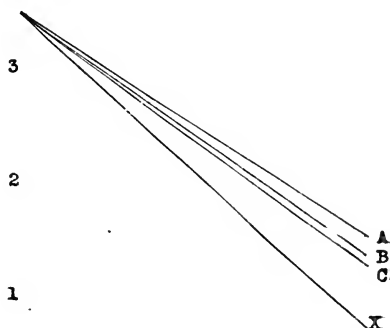


CHART II.

Showing a comparison of the effect on visual efficiency or power to sustain clear seeing of varying the intensity of light for the four installations of lighting used: the indirect, semi-indirect, and direct systems, 8 lamps; and the direct system, 16 lamps.

these shorter lamps, the spot of light on the ceiling, for the indirect system especially, was made smaller and correspondingly more brilliant. It was considered to be a point of interest in relation to the general problem to determine whether this comparatively small change in illumination effects would cause any difference in the eye's ability to hold its power to sustain clear seeing. The results of the tests for the different intensities of light for the three systems of lighting are shown in Chart II. In Chart III is given a comparison of results for the indirect system for the lamps of different wattages with and without socket extenders.

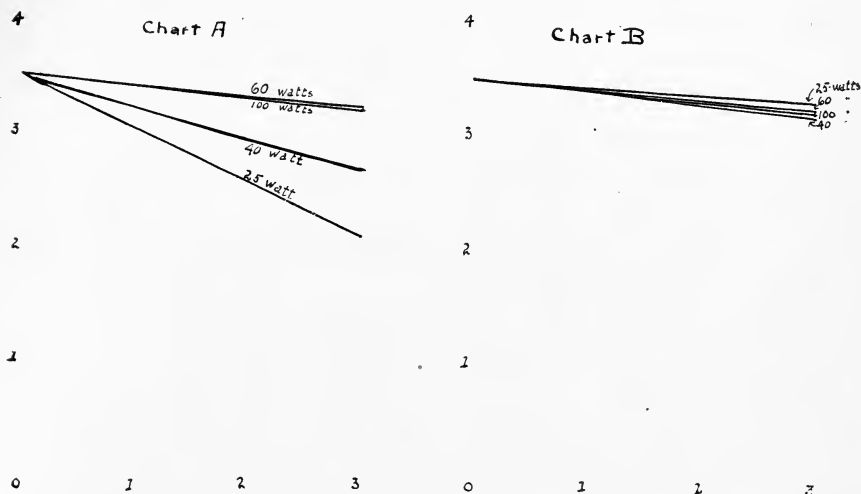


CHART III.

Showing the effect on visual efficiency or power to sustain clear seeing of changing the height of the light source in the reflector of the indirect lighting fixtures. The effect on surface brightness is primarily to change the area and surface brilliancy of the spot of light thrown on the ceiling. Chart A shows the results when height of source in the reflector is changed; Chart B, the results when the height is kept approximately constant.

In the work under the first and second sets of conditions the influence of difference in the distribution factors, more especially surface brightness, was clearly revealed by the use of wide variations in illumination effects. In the third set of conditions much smaller variations were employed. Such differences in effects were included as could be obtained by employing semi-indirect reflectors alone ranging from medium to dense. Six sets of reflectors were used, similar in size and shape and

differing only in density. These reflectors were furnished by the Holophane Works of the General Electric Co., with special reference to the needs and purpose of the investigation. They were all of the bowl type and 8 inches in diameter. Reflector I is a pressed Sudan toned brown; Reflector II a blown white glass toned brown (an experimental product); Reflector III a pressed Sudan; Reflector IV a pressed Druid; Reflector V a blown Veluria; and Reflector VI a blown white glass (also an experimental product). Reflectors I, III, IV and V are commercial products, II and VI are inserted in the series to give gradations in density. These reflectors were installed 30 inches from the ceiling in accord with the principles of indirect lighting. The results for this series of experiments are represented in Chart IV. These reflectors are numbered in order of their density from greatest to least; that is, Reflector I is of the greatest and Reflector VI of the least density. In this connection it is scarcely needful to mention that the greater is the density of the reflector, the lower is the brilliancy of the surface which it presents to the eye.

Type of Reflector	Volts	Foot-candles		45°
		Horizontal	Vertical	
I.....	111	4.1	1.14	2.7
II.....	110	3.7	1.13	2.6
III.....	107.5	4.2	1.16	2.6
IV.....	105.5	3.8	1.15	2.5
V.....	105.5	3.7	1.15	2.6
VI.....	107.5	4.2	1.16	2.7

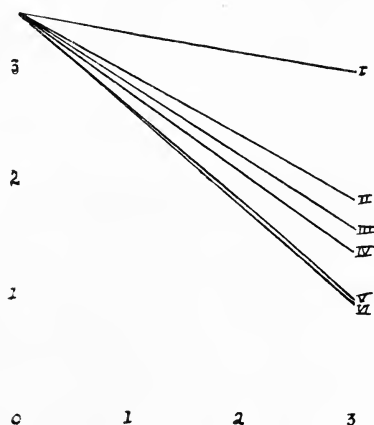


CHART IV.

Showing the tendency of the six types of semi-indirect reflectors to cause the eye to lose in efficiency, or power to sustain clear seeing.

In the tables referred to on a previous page (omitted from this article) we have shown for the sake of completeness of representation the gradation of surface brightness in three ways. (1) Brightness measurements of prominent surfaces have been made. (2) Ratios have been given between surfaces of the first, second, third, etc., order of brilliancy, and surfaces of the lowest order of brilliancy; and between surfaces of the first, second, and third order of brilliancy and the brightness at the point of work. And (3) the mean variation from the average and the percentage of mean variation have been shown. In the consideration of these specifications a number of single items might be selected as of possible significance in relation to the effect on the eye. Among these may be mentioned the order of magnitude of the highest brilliancies; the average brilliancy;

Type of Reflector	Volts	Foot-candles		45°	Candle-power per square inch
		Vertical	Horizontal		
I....	111	4.1	1.14	2.7	0.264
II...	110	3.7	1.13	2.6	0.361
III...	107.5	4.2	1.16	2.6	0.392
IV...	105.5	3.8	1.15	2.5	0.614
V...	105.5	3.7	1.15	2.6	0.848
VI...	107.5	4.2	1.16	2.7	0.920

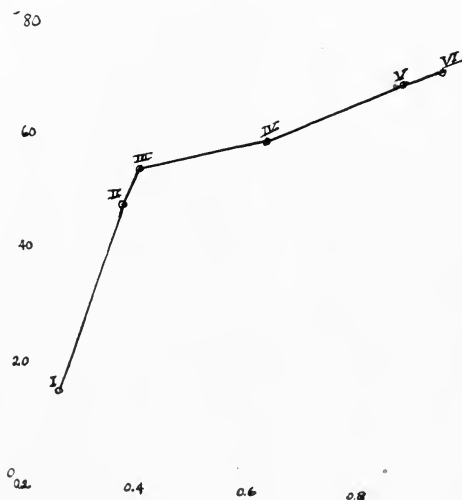


CHART V.

Showing the tendency of the six types of semi-indirect reflectors to cause the eye to lose in efficiency, or power to sustain clear seeing. Percentage drop in ratio-time clear to time blurred is plotted against brightness of reflector in candlepower per square inch.

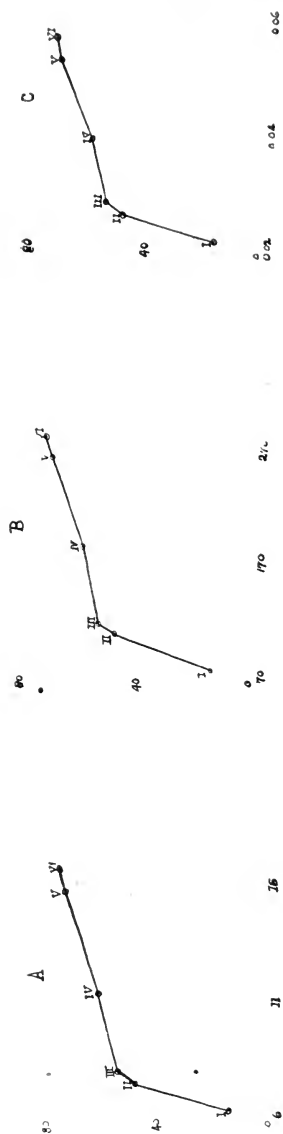


CHART VI.

Showing the tendency of the six types of semi-indirect reflectors to cause the eye to lose in efficiency, or power to sustain clear seeing. In Curve A, percentage drop in ratio time clear to time blurred is plotted against ratio of average brightness to brightness at the point of work; in B, against ratio of lightest surface to brightness at the point of work; and in C, against average brightness.

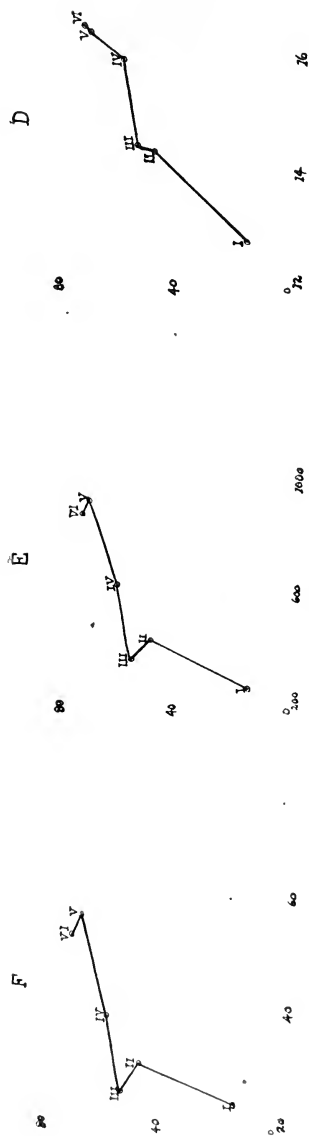


CHART VII.

Showing the tendency of the six types of semi-indirect reflectors to cause the eye to lose in efficiency, or power to sustain clear seeing. In Curve D percentage drop in ratio time clear to time blurred is plotted against ratio of lightest surface to average brightness; in E, against ratio of lightest surface to darkest surface; and in F, against ratio of average brightness to darkest surface.

the ratio of the highest to the lowest order of brilliancy; the ratio of the highest order of brilliancy to the brilliancy at the point of work (brightness of test-object and reading page); etc. In order to see which of these correlate most closely with the results of the test, curves have been constructed in which some of these features are plotted against the results of the test. These curves are given in Charts V-VII. In Chart V percentage loss of visual efficiency is plotted against the highest order of brilliancy, namely the brightness of the reflector. In Charts VI and VII are grouped the remainder of the curves.

In the fourth series of experiments it was decided to use the same density of glassware as was used in the third and to install the reflectors in accord with the principles of direct lighting. It was decided also to supplement this series by experiments with totally opaque reflectors with different linings and of different designs and depths, and with the prismatic glassware: In all fifteen different types of reflectors are being used in this series. The investigation is still in progress. No attempt will be made, therefore, at this time to give a detailed statement of results. An account of the work will be given in a later paper.

THE EFFECT OF EXTERNAL INCENTIVES ON IMPROVEMENT

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It is generally agreed that a close relationship exists between interest and effort in all types of mental work. The present attitude towards this relationship is altering the contents of the curriculum and the form of instruction. Two methods of stimulating effort may be contrasted in their extreme form:

(1) That in which an appeal is made to the interest of the subject itself by showing the pupil its close relationship to some dependent and desired activity.

(2) That in which there is a resort to the use of rewards or incentives which are external to the process itself.

No one doubts that the so-called direct interest is superior to that which is artificially stimulated by reward which has little to do with the actual process. While it is not the business of an experimental study to consider the philosophy of this method, it may be pointed out that the justification of the use of the latter means of stimulating interest in the classroom is, that many of the processes especially in their initial and mechanical stages, do not make a direct appeal to the large number of pupils who have only a moderate degree of intellectual interest. In this case in which the work is performed with an external aid, it is the natural hope that the interest which first attaches to the reward will transfer to the process itself. Moreover, external incentives need not of necessity interfere with the direct interest. It is a mistake to banish from the schools a sound method, because in its extreme form that method may lead to abuse. Certain authors who depreciate the use of any artificial incentives, in the nature of external rewards and punishments, nevertheless, take the general position that the schools should reproduce the sound methods of the outside world. It is difficult to see that a method which is such a driving-power in the life of society should have no application in the schools. As adults, all except the chosen few are quite ready to admit that the external rewards of their work are by no means negligible in their motivation. It is conceivable that we are hypocritical enough

to expect children to work from higher motives than those by which we ourselves are actuated.

The first question that arises in connection with this subject is the extent to which an increased interest stimulates an increased effort. Is this degree exaggerated or minimized in the minds of those who are in charge of instruction? It is to throw light on this question that the present study of the relation between incentive and rate of improvement has been undertaken. It is of course impossible to estimate scientifically the amount of incentive employed in the same way as we can measure the product produced. For this reason the present study, though quantitative on the side of measuring the improvement, is of necessity merely descriptive on the incentive side. We cannot say that x additional units of incentive produced an increase y in product, but we can say that a group under such and such external conditions improves at this or that rate. The question however is of such importance, that in spite of this lack of quantitative treatment, it is worth investigation.

The general method of the experiment was to give extended practice in three tests to two similar groups of children, one group working under the normal conditions of the classroom, while the other was motivated by external incentives.

The subjects for this study were: thirty-six boys and girls from grade 5A in the Cleveland Observation School. The following tests were used in the experiment to measure the rate of improvement:

I. The Simple Addition Test used by Thorndike.¹

II. The Cancellation Test described by Woodworth and Wells.²

III. The Digit Symbol Test where figures are substituted for numerals.

The initial efficiency of the subjects of the experiment was measured in the three tests. They were then divided into two equal groups on the basis of their initial scores in the Addition Test. These groups were not exactly balanced in the final results, because some of the original subjects were absent. The final data were furnished by sixteen individuals in each group. The periods allowed each day were ten minutes for the Addition

¹ American Journal of Psychology, Vol. 21, 1910, p. 483.

² Association Tests Psychology Monog., Vol. XIII, No. 5.

Test, one minute for the Cancellation Test, and five minutes for the Substitution Test.

The tests, as well as the basis of scoring were explained in detail. For each addition, cancellation and substitution, one point was allowed; for an omission or error a point was subtracted. The papers were distributed face downward, and an opportunity was given for questions to be asked. This was followed by the signal to commence work. After the preliminary trial, the tests were administered on nine successive days omitting Saturday and Sunday. In this way the curves of improvement were obtained, extending over ten periods. It may be added that the same experimenter administered the tests on all occasions to both groups.

One group, referred to in this paper as Group A, received the external incentives to be described later; the other, Group B, received no external incentives apart from the fact that they were informed of the number of errors made in addition. Thus, while Group B was stimulated merely by the novelty of the test, the interest in the work and the fact that it was done under conditions of serious school work, Group A had all these incentives in addition to the following:

- (1) Each individual's results of the previous day were published.

- (2) On sheets presented for the day's work, the point reached on the last occasion by the subject was marked in heavy blue pencil.

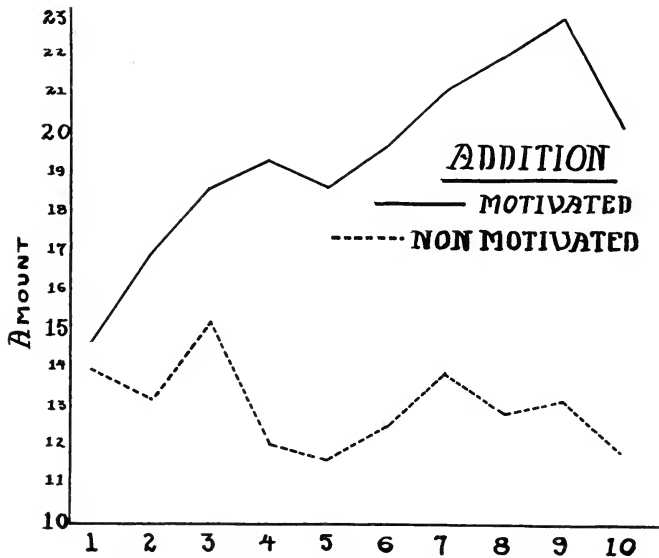
- (3) The general improvement of the class was presented in the form of a graph.

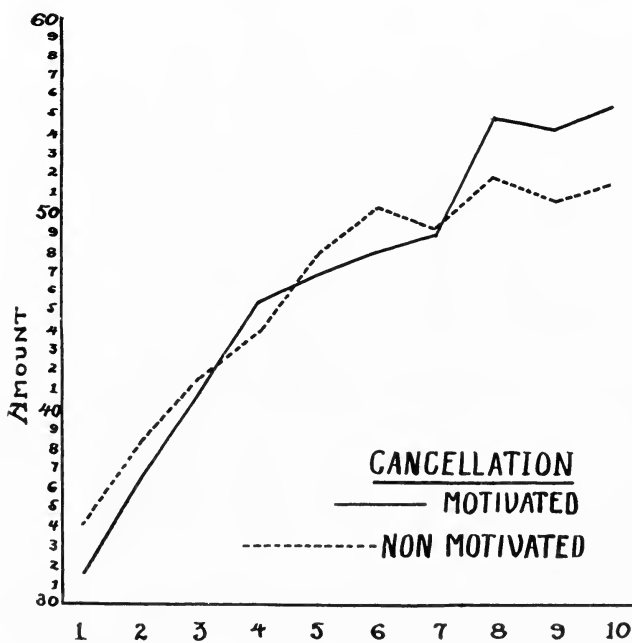
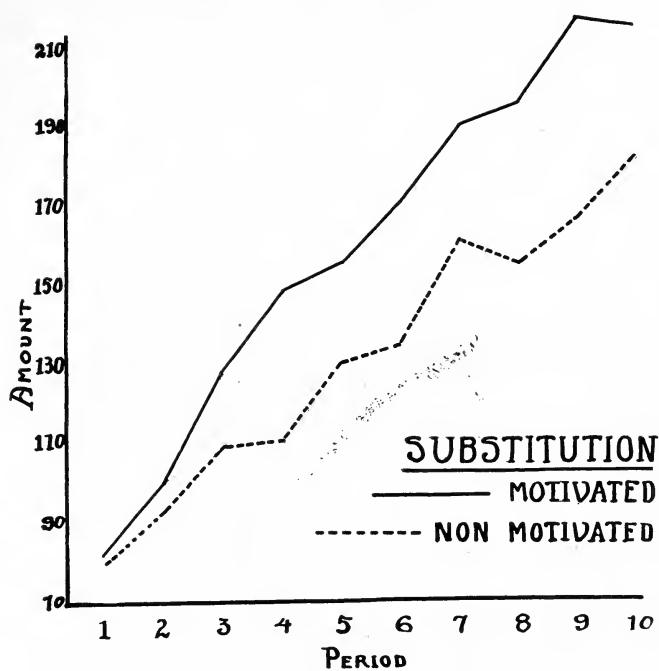
- (4) Credits were given in the form of stars, (a) to those who, as regards product produced on the previous day, were in the upper fifty per cent. of the class; (b) to those who, as regards amount of gross improvement, were in the upper fifty per cent. of the class. It was understood that prizes of a merely nominal value were to be given at the end of the ten practice periods to the fifty per cent. in Group A which had gained the greatest number of stars for efficiency and improvement.

In the following table the average results are presented. The scores in every case are corrected for errors on the basis explained previously. The number of individuals in each group for which the data are presented is sixteen.

Function	Group	Average Score During Period										Average S. D. of columns 1, 5, 10
		1	2	3	4	5	6	7	8	9	10	
Addition (10 mins.)	Motivated	14.7	16.9	18.6	19.3	18.6	19.7	21.1	22.0	23.0	20.2	10.4
	Non-motivated	14.0	13.3	15.2	12.0	11.7	12.5	14.4	12.8	13.1	11.9	6.1
Substitution (5 mins.)	Motivated	81	100	128	148	155	171	191	196	217	215	33.6
	Non-motivated	79	92	108	111	130	139	161	155	166	181	46.0
Cancellation (1 min.)	Motivated	32.0	36.4	40.8	45.2	46.8	48.0	48.8	54.9	54.1	55.2	7.3
	Non-motivated	34.0	38.2	41.6	44.0	47.9	50.1	49.1	51.9	50.6	51.2	10.6

These results are presented graphically in figures 1-3:





From the nature of the experiment and the range of individual difference in the class, the probable error of each isolated value in the table is somewhat great, but the general trend of the results shows that the incentive exerted a considerable effect on the amount of the product. It is significant that it is only in the cancellation test that the non-motivated group improves to the same extent as the motivated. In interpreting this cancellation result, it should be remembered that the length of practice over the ten periods was only ten minutes. We should not expect therefore the novelty of the test to wear off. It was only necessary for the subjects to do maximum work on each occasion for a single minute. This apparently can be accomplished without external incentives. It is when we come to the other tests which require more lengthy periods of work, that we notice the difference in the gain. In the substitution test there is five minutes of novel work, in the addition test there is ten minutes of work which is very similar to the ordinary school routine. We should therefore expect the improvement in the motivated group to exceed the improvement in the other group less in cancellation than in substitution and less in substitution than in addition. This is found to be the case, in fact in addition the non-motivated group actually falls off in efficiency. When we consider that the ordinary school work demands continuous effort over long periods of time, with but little zest of novelty, it may be surmised that the necessity of motivating the work becomes increasingly great. If such large results are found over short periods of work of fifty and one hundred minutes, what must be the failure to secure maximum effort when the work extends over fifty or a hundred hours.

This research has investigated the effect of external incentives; it is desirable that investigation be made, if possible, of rates of improvement when the material of the work is interesting by reason of its relation to some desired activity of the group. This problem it is hoped may be attacked quantitatively later.

A DETAILED STUDY OF WHIPPLE'S RANGE OF INFORMATION TEST

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In a test of size of vocabulary, such as that of Kirkpatrick¹ or Terman,² the words are selected in systematic order from an extensive word list (in these cases a small dictionary), and the size of the individual's vocabulary is assumed to be proportional to the number of words of the selected list which are correctly defined. The selection is made on a strictly numerical basis, and is assumed to be representative of the entire list. In Whipple's Range of Information Test,³ which is a form of vocabulary test, the one hundred words of the test list are selected on an entirely different principle. From each of one hundred fields of human knowledge a word is selected of such basic significance that anyone at all conversant with the work of that field would be apt to know it, yet so technical that it could scarcely be defined on the basis of general information. Thus each word is supposed to be fairly representative of its field, and familiarity with the word would indicate a considerable acquaintance in that field. For example, "vantage-in" represents tennis, "Bernard Shaw," modern dramatic literature, "puer," Latin, "luff," sailing, "guimpe," dress-making, and "kilogram," the metric system.

The method of procedure used in the present study of this test was that recommended by Whipple, and printed on the test sheets. The test was given to an entire class at one time, and the students were asked to place before each word one of the following letters: D, if the word could be defined exactly, as in a dictionary; E, if an exact definition could not be given, but the word could be explained well enough to give some idea of its meaning to one who was not familiar with it; F, if the word was merely roughly familiar, and could not be used intelligently;

¹ E. A. KIRKPATRICK. *A Vocabulary Test*. Popular Science Monthly, 70: 1907, 157-164.

² L. M. TERMAN AND H. G. CHILDS. *A Tentative Revision and Extension of the Binet-Simon Measuring Scale of Intelligence*. Journal of Educational Psychology, 3: 1912, 205-208.

³ G. M. WHIPPLE. *A Range of Information Test*. Psychological Review, 16: 1909, 347-351. Also in Manual of Mental and Physical Tests, first edition, 1910, p. 465, and in the second edition, 1915, Part II, p. 317.

and N, if the word was entirely new or unknown. The students were told in advance that they would be asked to define or explain some of the words marked D or E, and when they had finished marking they were told to write on the back of the sheet the definitions of the first three words marked D. No use was made of these written definitions in computing the results, and the object in asking for them was merely to induce an attitude of care and accuracy in the marking. The score is, therefore, an indication not of what the subjects actually know, but of what they think they know. In some cases probably advantage was taken of this, and the papers were deliberately marked too high. In the vast majority of cases, however, the students were perfectly honest, and the scores represent accurately their own opinions of their familiarity with the words. Their actual knowledge is somewhat lower than the markings indicate, for casual testing shows that from two to five words marked D or E on each paper prove to be instances of false association when the definition or explanation is given. Thus the score represents the upper limit of the subject's possible range of information, rather than the actual attainment.

The only published records of the use of the test are those by the author of it and by Miss Laura L. Smith,⁴ of the University of Texas. Neither of these writers gives more than the average number of D's, E's, F's, and N's for each group of students tested. The present writer was so fortunate as to have access to Miss Smith's original test sheets through the kindness of Professor C. S. Yoakum. To these were added records from 28 seniors and 157 freshmen, making a total of 81 seniors, 59 juniors, 84 sophomores and 372 freshmen, or 596 students in all.

The object of the present study was to ascertain how each group of students responded to each word of the test. To do this the total number of D's, E's, F's and N's was computed for each word and for each group of students. Then arose the problem of reducing these numbers to a single numerical value for each word. After experimentation with various forms of weighting and correspondence with Professor Whipple, it was decided to adopt his suggestion of letting D equal 1, E equal 1, F equal .5, and N equal 0. This method of weighting seems

⁴LAURA L. SMITH. *Whipple's Range of Information Test*. *Psychological Review*, 20: 1913, 517-518.

to do violence to the distinction which the students were asked to make between D and E, and in all probability the mark E represents a lower degree of certainty about a word than the mark D. Objectively, however, it was found practically impossible to distinguish between definitions and explanations, and in the absence of more definite knowledge it was thought undesirable to burden the computations with a more complicated system of weighting. These weighted scores were then expressed in per cents. of the total possible score. The scores in Table I may therefore be interpreted as percentages of familiarity as judged by the students.

The words in Table I are arranged in the order of decreasing familiarity according to the combined scores of the entire body of 596 students. The preponderance of freshmen in this number tends to make these scores unduly low, since the freshmen scores are considerably lower than those made by the other classes. Perhaps a fairer indication of the performance of college students in general would have been given by combining directly the percentages obtained by the four classes. It will be noted that the senior scores are invariably higher than the average, and as high as or higher than the junior scores in all but eleven cases (puer, way-bill, triangulation, nada, pyramidal tract, undistributed middle, Babcock test, midiron, f-64, amphioux, and Elohim). Several of these are undoubtedly due to the fact that the juniors had recently been working with such subjects as psychology, logic, and biology. The juniors and sophomores are the closest together of any of the classes. While the juniors are somewhat superior in the aggregate, they surpass the sophomores in only sixty out of the one hundred words. The freshmen surpass the sophomores in only seven words (kinesthetic, peneplain, Chartism, golden section, gneiss, mitosis, and impetigo). In some of these we may see the effect of recent studies in geology, history and biology. In nine words (X-ray, hydraulic press, nada, peneplain, gasket, midiron, f-64, chamfer, and midiron) the four classes are fairly close together. All but two of these words (nada and peneplain) depend upon general experience rather than upon college studies. With terms like Utopia, Caedmon, Les Miserables, Bernard Shaw, dryad, kinetic, cosmogony, etc., on the other hand, the seniors have advanced far beyond the freshmen. That stoicism ranks

TABLE I.

Familiarity of Test Words.

	596 Stu- dents	81 Seniors	59 Juniors	84 Sopho- mores	372 Fresh- men
1. X-ray.....	97	99	98	98	96
2. kilogram.....	91	96	91	92	90
3. quadratics.....	87	96	90	92	85
4. Utopia.....	86	99	95	94	80
5. Stoicism.....	85	98	94	95	79
6. R. S. V. P.....	82	91	86	83	79
7. hydraulic press.....	77	80	77	79	76
8. cotangent.....	77	92	83	88	70
9. Caedmon.....	76	96	89	95	65
10. Les Miserables.....	76	98	92	92	65
11. chlorine.....	74	83	75	73	73
12. puer.....	74	79	82	83	69
13. clearing-house.....	73	84	83	75	69
14. base-hit.....	70	77	77	74	67
15. natural selection.....	70	93	83	76	62
16. entree.....	68	84	72	74	63
17. wigwag.....	68	77	75	67	65
18. Euclid.....	68	94	82	77	58
19. spoils system.....	67	86	74	70	62
20. simony.....	67	71	69	80	63
21. electrolysis.....	67	78	70	68	63
22. Anthony Wayne.....	64	78	62	66	60
23. Bernard Shaw.....	62	90	72	64	55
24. calorie.....	62	74	65	64	59
25. Zionism.....	60	82	80	74	48
26. f. o. b.....	57	66	57	57	55
27. kinesthetic.....	56	87	76	42	51
28. impressionism.....	56	79	57	59	51
29. synecdoche.....	55	74	73	71	45
30. guimpe.....	55	67	55	59	51
31. linotype.....	54	65	62	56	51
32. dryad.....	54	78	66	56	46
33. Millet.....	52	67	43	58	49
34. tort.....	49	67	62	60	40
35. kinetic.....	48	74	52	59	39
36. Polonius.....	48	72	50	51	41
37. way-bill.....	47	57	63	51	42
38. triple-expansion.....	46	53	51	46	43
39. catalepsy.....	41	65	57	49	32
40. ohm.....	41	51	39	49	38
41. triangulation.....	40	49	53	43	36
42. vantage-in.....	39	57	50	43	32
43. nada.....	39	39	43	47	37
44. chromosome.....	38	46	42	47	33
45. call-loan.....	38	57	52	42	29
46. dietetics.....	37	56	38	47	32
47. pyramidal tract.....	35	44	50	35	31
48. metacarpal.....	34	52	60	39	24
49. penepplain.....	32	33	30	30	32
50. Pestalozzi.....	32	70	42	42	19

TABLE I (Continued)

	596 Stu- dents	81 Seniors	59 Juniors	84 Sopho- mores	372 Fresh- men
51. glycogen.....	31	46	50	42	22
— 52. testudo.....	31	45	41	42	24
53. annealed.....	31	46	39	34	25
54. dibble.....	29	38	30	36	26
55. cosmogony.....	28	57	41	37	18
56. undistributed middle.....	28	45	54	30	19
57. morgen.....	28	54	35	28	20
58. Babcock test.....	25	32	37	29	21
59. aujourd'hui.....	23	39	27	26	19
60. parallax.....	22	36	24	34	16
61. Chartism.....	22	38	25	17	19
— 62. golden section.....	21	30	20	16	21
— 63. gasket.....	21	23	23	23	19
64. gneiss.....	21	35	21	17	18
65. infusoria.....	21	30	29	29	16
66. Bokhara.....	20	37	19	23	16
67. scherzo.....	20	35	25	22	16
✓ 68. mitosis.....	19	33	28	11	17
69. architrave.....	19	44	17	26	12
70. Kepler's law.....	19	35	34	25	12
71. logos.....	18	47	36	23	8
72. Eocene.....	18	46	32	20	9
73. apocalypse.....	18	41	27	24	10
74. cantilever.....	17	25	21	21	14
75. homiletics.....	17	36	23	23	11
76. semaphore.....	16	28	19	16	14
77. Weismannism.....	15	32	24	23	9
78. Malthus' law.....	15	40	40	16	5
79. hedonism.....	14	49	19	20	6
— 80. amphora.....	14	36	20	18	8
81. rococo.....	14	35	26	12	8
82. luff.....	14	28	16	20	9
83. midiron.....	14	16	18	15	13
84. f-64.....	13	15	19	16	12
85. cephalic index.....	13	34	15	18	7
86. trilobite.....	13	25	20	10	10
87. amphioxus.....	12	22	33	18	6
88. pomology.....	11	20	14	11	9
89. ceramics.....	10	30	13	10	6
90. chamfer.....	10	11	14	8	9
91. hemiptera.....	10	18	16	15	6
— 92. noi.....	9	20	3	12	7
— 93. ageratum.....	9	14	14	13	6
— 94. gambit.....	9	16	7	12	7
— 95. trephine.....	9	17	17	8	6
— 96. intaglio.....	8	15	9	9	6
97. Braille.....	7	14	13	7	5
98. impetigo.....	7	9	5	5	7
99. Elohim.....	6	13	15	7	3
— 100. cleistogamous.....	2	6	4	1	1

so high in the list and hedonism so low is probably merely the reflection of popular usage rather than the result of any study of the history of philosophy. The position of *puer* shows the influence that Latin still has on the vocabulary of college students, while *base-hit* reveals the potency of the great American game. In comparison *vantage-in*, *luff* and *midiron* make a very poor showing. Natural selection stands commendably high in view of the low scores received by most biological terms. The score of the freshmen on Euclid shows how little attention is paid in high schools to the historical aspects of geometry. The high score of the sophomores on "*simony*," and the fact that two sections of freshmen marked it even higher, point to a special explanation of the term by some university instructor. "*Kinesthetic*" marks the study of psychology by the juniors and seniors, while "*kinetic*" reaches down to include the sophomores. It is strange that the freshmen are so ignorant of "*Polonius*," although all have probably read Hamlet in the high school. "*Triangulation*" indicates the results of the junior work in engineering, and "*call-loan*" furnishes the freshman an alibi against any charge of high finance. The freshman score on "*metacarpal*" gives ground for an arraignment of the anatomy and physiology taught in the high school, and "*Pestalozzi*" testifies to the study of the history of education by seniors. That such terms as "*annealed*," "*scherzo*," "*cantilever*," "*trepine*," and "*Braille*" stand so low on the list is somewhat surprising. A similar study of the test on students in other localities would be of interest.

While Whipple and Miss Smith have given us the average scores of students in the different college classes, it was thought that a computation of the range of distribution of individual scores in each class might be of interest. This is presented in Table II in the form of a ten-percentile table of the individual scores. The returns from only 226 freshmen were available for this.

It is doubtful whether this highest freshman score should be allowed to stand, as the next highest score was only 66.0. The fifty-percentile values show a fairly close agreement with the averages given by Whipple and by Smith.

Since it is the purpose of this test to reveal the subject's familiarity with various fields of knowledge, it was thought that it

TABLE II.

	Lowest	10 per cent	20 per cent	30 per cent	40 per cent	50 per cent	60 per cent	70 per cent	80 per cent	90 per cent	Highest
81 Seniors.....	21.0	36.5	44.0	47.0	49.5	52.5	57.0	58.5	60.5	68.0	78.5
59 Juniors.....	23.5	34.5	38.0	40.0	41.5	44.0	47.0	49.5	53.5	58.5	69.0
84 Sophomores.....	16.0	28.0	31.5	35.0	37.0	39.5	44.0	47.0	51.0	59.0	72.0
226 Freshmen.....	11.5	23.0	26.0	29.0	31.5	33.0	36.0	38.0	42.0	48.0	83.0

would be of interest to combine the terms into rather large groups to see how the classes compared from this point of view. The following more or less arbitrary grouping of the terms was decided on.

1. History and literature (11)

Anthony Wayne	apocalypse	Bernard Shaw
Caedmon	Chartism	dryad
Elohim	Les Miserables	Polonius
synecdoche	Utopia	

2. Language, including musical, social and household terms (11)

aujourd'hui	entree	guimpe
logos	morgen	nada
noi	puer	R. S. V. P.
scherzo	testudo	

3. Philosophy, including education, politics and theology (11)

Braille	cosmogony	golden section
hedonism	homiletics	Pestalozzi
simony	spoils system	stoicism
undistributed middle	Zionism	

4. Physical sciences and mathematics (18)

calorie	cantilever	chlorine
cotangent	electrolysis	eocene
Euclid	gneiss	Kepler's law
kilogram	kinetic	ohm
parallax	peneplain	quadratics
triangulation	trilobite	X-ray

5. Biological sciences (12)

ageratum	amphioxus	Babcock test
chromosome	cleistogamous	hemiptera
infusoria	Malthus' law	mitosis
natural selection	pomology	Weismannism

6. Anatomy, physiology, hygiene and psychology (9)

catalepsy	cephalic index	dietetics
glycogen	impetigo	kinesthetic
metacarpal	pyramidal tract	trephine

7. Arts and manufactures (16)

amphora
ceramics
f-64
impressionism
Millet
triple expansion

annealed
chamfer
gasket
intaglio
rococo

architrave
dibble
hydraulic press
linotype
semaphore

8. Business (6)

Bokhara
f. o. b.

call-loan
tort

clearing house
way-bill

9. Sports and games (6)

base-hit
midiron

gambit
vantage-in

luff
wigwag

TABLE III.

Scores by Groups of Terms.

	Seniors	Juniors	Sophomores	Freshmen	Total	Per cent of increase
History and literature (11) ..	71	61	58	44	52	67
Physical Sciences, etc. (18) ..	62	54	53	45	50	34
Business (6)	61	56	51	42	47	45
Languages, etc. (11)	55	46	45	36	41	58
Philosophy, etc. (11)	57	48	45	32	39	75
Sports and games (6)	45	41	39	32	36	41
Anatomy, etc. (9)	46	41	32	24	29	92
Arts and Manufactures (16) ..	42	32	32	26	29	62
Biological sciences (12)	32	30	24	16	21	100

History and literature stand highest with a total average score of 52, while the biological sciences are lowest with a score of 21. In the last column is given the percentage of increase of the senior over the freshman scores. As was perhaps to be expected, the percentage of increase is highest in the biological sciences, in which the freshmen make the lowest score, and lowest in the physical sciences, in which the freshmen make their best showing. Whether there is any correlation between results in this test and excellence in college work is still to be determined.

APHASIC PERFORMANCE IN THE TERMAN VOCABULARY TEST

F. L. WELLS

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X, a man aged 72, was admitted to hospital care February 16, with history of a mild shock some four months previously, affecting the right side for about two months. Since then he has failed physically and mentally, especially in memory. Sometimes he is clear, then again cannot remember names or recognize persons, is neglectful of business obligations, issues checks irresponsibly, becomes disoriented. Clinically, the case is one of arteriosclerotic psychosis.

Under the Stanford series, March 13-14, the IQ was .57, the only successes recorded above year IX being in vocabulary, backward memory for digits and comprehension. Below this level, a peculiar difficulty appeared in the language tests. In differentiating wood and glass it is replied that "Wood can be ignited and give out heat; glass . . ." (Nothing more elicited) (Stone and egg): "Very little sustenance in a stone; may be sustenance in an egg." (Fly and butterfly): "Why, the construction, the looks . . ." (Cannot be got to specify). It would seem that the difficulty is not one with the objects or task, but in calling up, "propositionizing" the words needed for correct response.

In the Vocabulary test, the unusual feature was noted, that the words missed were scattered fairly evenly throughout the list, instead of being, as normally, heaped up towards the more difficult end. The speech difficulty noted with the other tests appeared to be mainly responsible for this, the words being understood, but impossible to explain. On the next day, March 14,¹ the complete Vocabulary list was repeated by a method of "cued combination," in which a determining cue of the word to be tested is given in a short sentence of appropriate context. Examples are:

The boy was sucking a big ripe or --- e
A cent is made of co ----

¹ The impairment in the patient's memory has been noted. In the tests, he failed at 6 digits (remembered 5 both forward and back), and produced only one "memory" for the fire episode (X 4). He failed on all the X year sentences. The memory of the first test should negligibly affect the results of the second.

The idea is that if the subject "knows" the word he can complete it, but if not, he cannot supply the missing part by guessing. With this method, the patient did very much better, and the failures were more normally distributed. The complete table of performance is as follows:

	By definition, March 13	By combination, March 14		By definition, March 13	By combination, March 14
1. orange.....	+	+	51. peculiarity.....	-	+
2. bonfire.....	+	+	52. coinage.....	+	+
3. roar.....	+	+	53. mosaic.....	-	+
4. gown.....	+	+	54. bewail.....	+	+
5. tap.....	-	+	55. disproportionate...	+	-
6. scorch.....	+	+	56. dilapidated.....	+	+
7. puddle.....	-	+	57. charter.....	+	+
8. envelope.....	+	+	58. conscientious.....	+	+
9. straw.....	-	+	59. avarice.....	+	+
10. rule.....	+	+	60. artless.....	-	-
11. haste.....	+	+	61. priceless.....	-	+
12. afloat.....	+	+	62. swaddle.....	-	+
13. eye-lash.....	+	+	63. tolerate.....	-	+
14. copper.....	+	+	64. gelatinous.....	+	-
15. health.....	+	+	65. depredation.....	-	+
16. curse.....	-	-	66. promontory.....	-	+
17. guitar.....	+	+	67. frustrate.....	+	+
18. mellow.....	+	-	68. milksop.....	+	-
19. pork.....	-	+	69. philanthropy.....	-	-
20. impolite.....	-	+	70. irony.....	+	+
21. plumbing.....	-	-	71. lotus.....	+	+
22. outward.....	+	+	72. drabble.....	-	-
23. lecture.....	-	+	73. harpy.....	-	-
24. dungeon.....	-	+	74. embody.....	+	-
25. southern.....	+	+	75. infuse.....	+	+
26. noticeable.....	+	-	76. flaunt.....	-	+
27. muzzle.....	+	+	77. declivity.....	+	+
28. quake.....	-	+	78. fen.....	-	-
29. civil.....	-	+	79. ochre.....	+	+
30. treasury.....	-	+	80. exaltation.....	+	-
31. reception.....	+	+	81. incrustation.....	-	-
32. ramble.....	+	+	82. laity.....	+	+
33. skill.....	-	+	83. selectman.....	+	+
34. misuse.....	-	+	84. sapient.....	-	-
35. insure.....	-	+	85. retroactive.....	-	-
36. stave.....	-	+	86. achromatic.....	-	-
37. regard.....	+	+	87. ambergris.....	+	+
38. nerve.....	-	+	88. casuistry.....	-	-
39. crunch.....	+	+	89. paleology.....	-	-
40. juggler.....	-	+	90. perfunctory.....	-	-
41. majesty.....	-	+	91. precipitancy.....	+	+
42. brunette.....	+	+	92. theosophy.....	-	+
43. snip.....	+	+	93. piscatorial.....	+	+
44. apish.....	+	-	94. sudorific.....	-	-
45. sportive.....	½	-	95. pârterre.....	-	-
46. hysterics.....	+	+	96. homunculus.....	-	-
47. Mars.....	+	+	97. cameo.....	+	+
48. repose.....	-	+	98. shagreen.....	-	-
49. shrewd.....	+	+	99. limpet.....	-	-
50. forfeit.....	-	-	100. complot.....	-	-

Out of this table result the following figures:

		1-50	51-100	1-100
Total words by cued combination.....		43	25	68
" " " definition.....		29	22	51
" " " comb. but not by def.....		18	8	26
" " " def. but not by comb.....		4	5	9
" " neither by comb. nor def.....		3	20	23

On March 16 the patient is described as occasionally disoriented as to time, thinking he has been here two or three months, does not know days of the week, at 2 o'clock will think it is bed-time. At times he does not know the names of the nurses, and forgets simple words, like "collar-button." He was questioned along these lines on March 16, and again, March 19, his abilities at the two interviews comparing as follows:

	March 16	March 19
Knows examiner's name.....	+	+
Knows approx'mate date.....	—	+
Knows name of hospital.....	—	—
Recognizes name of hospital among others.....	+	+
Knows approximate time of day.....	+	—
Knows Governor of Massachusetts.....	—	—
Knows President and Vice-president.....	+	+

On March 19 he had looked at the clock and told the time correctly (10.25) at the examiner's entry; seven minutes later he gave the time as "about 11.30; I haven't looked at the clock since 9.30."

He seemed in general a little brighter on this morning, and said himself that he felt so. Certain words with imperfect responses on March 13-14 were repeated, according to groups as below. Each group was first given by cued combination, and then the definition of each word in the group was asked. Except in the column marked with an asterisk, if correct response did not appear in 30 seconds, failure was scored. Prompting or urging were avoided. Grading of definitions was fairly close, minus being recorded for such as, impolite—"a condition one should never take towards a stranger . . . not polite." Quake—"excited, lose your . . ." Plumbing—"a condition in which you place certain material in your house, say lead or copper." These insufficient definitions are fair examples of the patient's word-amnesia.

Results for the March 19 observations were as follows:

March 19—Words Known March 13 by Combination but not by Definition

	By comb.	By def.		By comb.	By def.		By comb.	By def.
tap.....	+	—	treasury....	+	—	peculiarity...	—	+
puddle....	+	+	skill.....	+	—	mosaic.....	+	—
straw.....	+	—	misuse.....	+	+	priceless.....	+	+
pork.....	+	—	insure.....	+	—	tolerate.....	+	+
impolite...	+	—	stave.....	—	—	depredation...	—	—
lecture....	+	—	nerve.....	+	+	promontary...	+	—
quake.....	+	—	juggler.....	+	+	flaunt.....	+	+
civil.....	+	—	majesty....	+	—	theosophy....	—	—
			repose.....	+	+			

*Words Known March 13 by
Definition but not by
Combination*

	By comb.	By def.
mellow.....	—	+
noticeable.....	—	+
apish.....	—	—
sportive.....	—	—
carnage.....	+	+
disproportionate..	—	+
gelatinous.....	+	+
milksoap.....	—	+
exaltation.....	—	+

*Words Known March 13 neither by Definition nor by
Combination*

	By comb.*	By def.		By comb.	By def.
curse.....	—	—	harpy.....	+	—
plumbing....	+	—	embody....	+	+
forfeit.....	+	+	fen.....	—	—
artless.....	+	—	incrustation.	—	—
swaddle.....	—	—	sapient.....	—	—
philanthropy..	—	—	perfunctory.	—	—
drabble.....	—	—			

Of these 46 words, 12 are now known both by combination and by definition; 16 others are known by combination but not by definition; 5 others are known by definition but not by combination; and the remaining 13 are known by neither combination nor definition.

The writer has several times given the Vocabulary test, not by calling for definition, but by cued combination as above. The subject is later asked to define any words he has failed to combine, which adds a few words to his score. Most of the words seem harder to combine in this way than to define by Terman's liberal standards, which themselves allow the use of the word in a sentence. But the speech disorder in this patient has left the ability of combination relatively intact, while much disturbing the association between even easy words and other words which describe their meaning.

Defining a word is not a test of "knowing" the word itself, but of knowing its relation to certain other words that describe it. Most people "know" in the sense that they can use, words like *be*, *and*, *but*, *unless*, much better than they can define them. On the other hand, rather unusual words like *noticeable* and

disproportionate are combined with difficulty, but more readily definable owing to their well known bases. *Southern* is a word in Terman's list that suffers in definition, but is readily combined. Some words are more fairly tested by combination, others by definition. For the whole Terman list, the advantage in time lies with procedure by definition. The easier words are somewhat more quickly disposed of by combination, but the harder words much more quickly by definition. The combination method is more adapted to group testing through written papers, tests spelling as well as "knowing" the word, and is somewhat simpler in scoring.

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Ohio Bd. of Administratn. Publictn. No. 8, Jan., 1916, 29 pp.
The heredity of Sam, who tested sixty by the Point Scale.
242. KRAMER, F.: *Intelligenzprüfungen an abnormen Kindern*.
Monatsschr. f. Psychiatr. u. Neurol. 1913, 33: 500-519.
The application of the scale to exceptional children, between 11 and 16, and to patients in the psychiatric clinic, ages 7 to 13.
243. KUHLMANN, F.: *Feeble-mindedness*.
Psychol. Bull. 1914, 11: 193-202.
An excellent review of the year's literature on the Binet scale in relation to feeble-mindedness.

244. KUHLMANN, F.: *Some Results of Examining a Thousand Public School Children with a Revision of the Binet-Simon Tests of Intelligence by Untrained Examiners. First Article.*

Jour. of Psycho-Asthen. 1914, 18: 150-179.

A clear-cut discussion of the ability of untrained examiners to administer the tests, further improvements which can be made in the scale, and the usefulness of test results to school administrators and teachers.

245. KUHLMANN, F.: *Some Results of Examining a Thousand Public School Children with a Revision of the Binet-Simon Tests of Intelligence by Untrained Examiners. Second Article.*

Jour. of Psycho-Asthen. 1914, 18: 233-269.

A large variety of fundamental questions discussed: the number expected to pass a test for a given age, the assumption of similarity in the number of advanced and retarded, the accuracy of the individual tests, uniformity of tests within the age group, etc.

246. KUHLMANN, F.: *The Mental Examination of Reformatory Cases.*

Jour. of Crim. Law and Criminol. 1914-1915, 5: 666-674.

The scale inadequate for determining the grade of intelligence of the average reformatory case. Intelligence quotient should be used in preference to other methods of determining degree of development.

247. KUHLMANN, F.: *Review: J. E. W. Wallin, The Mental Health of the School Child.*

Jour. of Psycho-Asthen. 1914, 19: 41-48.

A review and criticism of Wallin's conclusions regarding the "present status" of the scale, and the "menace" of amateur testers. (See later and following reference.)

248. KUHLMANN, F.: *Dr. Wallin's Reply to My Review of His "Mental Health of the School Child."*

Jour. of Psycho-Asthen. 1915, 19: 154-170.

249. KUHLMANN, F.: *The Importance and Methods of Determining the Mental Age of Subnormal Children.*

Proc. Wisconsin Teachers Assoc., Milwaukee, Nov. 5-7, 1914, pp. 286-296. Madison, Wis.: Democrat Printing Co., 1915.

Discusses the relative number of subnormal children in the school, their eugenic and educational importance. Gives mental ages of children in first five grades of the Faribault, Minn., schools. Explains the scale and advises its use in every school system.

250. KUHLMANN, F.: *What Constitutes Feeble-mindedness?*

Jour. of Psycho-Asthen. 1915, 19: 214-236.

An attempt to shed light upon a more satisfactory definition of feeble-mindedness. A discussion of current criteria.

251. KUHLMANN, F.: *Part Played by the State Institutions in the Care of the Feeble-minded.*

Jour. of Psycho-Asthen. 1916, 21: 3-24.

A discussion of the distribution of the feeble-minded in society in relation to mental age.

252. KUHLMANN, F.: *Distribution of the Feeble-minded in Society.*

Jour. of Crim. Law and Criminol. 1916, 7: 205-218.

The incidence of feeble-mindedness by mental age.

253. KUHLMANN, F.: *Mentality Tests: A Symposium*. (See later reference.)
 Jour. of Educ. Psychol. 1916, 7: 280-282.

The Binet scale is the best we possess. All the American revisions are improvements over the original. "The present danger to the future of psychology in this field lies much more in the psychologist's hostile attitude and destructive criticism of the Binet-Simon tests, which are admittedly imperfect, than it does in the errors in mental diagnosis resulting from their use, even when employed by relatively untrained examiners." Suggests better understanding of the tests. "The 'Point Scale' plan of allowing part credits . . . is wrong in principle when applied to all tests indiscriminately." General character of the tests and procedure for different age-periods must vary.

254. LAZAR, E., UND PETERS, W.: *Rechenbegabung und Rechendefekte bei abnormen Kindern*.

Fortschritte der Psychol. 1915, 3: 167-184.

255. LEWIS, O. F.: *The Feeble-minded Delinquent*.

Jour. of Crim. Law and Criminol. 1912, 3: 10-11.

The utmost care should be exercised in making estimates of feeble-minded among delinquents based on the results of tests.

256. LOBSIEN, M.: *Intelligenzprüfungen auf Grund von Gruppenbeobachtungen*.

Langensalza: Julius Betz, 1915, 59 pp.

Examined 40 pupils in their fourth "Mittelschule" year (chronological ages about 10). Correlation between teachers' estimate and results of tests plus 70%. Gave a number of Binet tests. Grouped his subjects.

257. LODGE, R. C., AND JACKSON, J. L.: *Reproduction of Prose Passages*.

Psychol. Clinic 1916, 10: 128-145.

Criticism of Miss Travis methodology. See later reference.

258. LUNDBERG, E. O., LENROOT, K. F., AND BROWNE, N. B.: *Mental Defectives in the District of Columbia*.

U. S. Dept. of Labor, Children's Bureau Publ. No. 13, 1915, 39 pp.

259. LURTON, F. E.: *A Study of Retarded Children in a Group of Northwestern School Systems*.

Reprint from Vol. 17, Part I, of Trans. Wisconsin Acad. of Sciences, Arts and Letters, 1912, pp. 275-298.

A consideration of the use of the scale for studying retardation.

260. LYMAN, GRACE: *Intelligence Tests in Relation to the Analysis of Intelligence*.

A thesis presented to the Department of Education, Leland Stanford, Jr., Univ., May 6, 1914. 94 pp.

A critique of current definitions of intelligence and an attempt to analyze the psychologic factors involved in the various tests of the scale (Stanford Revision).

261. MCCALLIE, J. M.: *Dangers of Classifying as Feeble-minded Children Who are Merely Backward*.

Proc. Nat. Conf. Char. and Corr. 1916, pp. 257-263; also Jour. of Psycho-Asthen. 1916, 21: 51-57.

Traces the progress through which intelligence diagnosis has passed. A great deal of exact knowledge should precede practice in the use of the scale.

262. MCCORD, C. P.: *One Hundred Female Offenders: A Study of the Mentality of Prostitutes and "Wayward" Girls*.

Jour. Crim. Law and Criminol. 1915-1916, 6: 385-407; also Training School Bull. 1915, 12: 59-67.

- Of 50 prostitutes examined (ages 22-41) 46% were of normal intelligence and 54% were feeble-minded. Their reactions are compared with those of 10 teachers of the same sex and age. Of the wayward girls 55% were normal, 45% feeble-minded.
263. MACMURCHY, HELEN: *Organization and Management of Auxiliary Classes*.
Dept. of Educ., Ontario, Canada. Educ. Pamphl. No. 7, 1915, 212 pp.
The diagnosis of mental defect and the determination of mental age in relation to auxiliary school problems.
264. MACMURCHY, HELEN: *First Annual Report of the Inspector of Auxiliary Classes of Ontario, 1915*.
Toronto: Wilgress, 1916, 45 pp.
Reviews some of the findings of tests upon delinquents.
265. MACMURCHY, HELEN: *Feeble-minded in Ontario, 1915*.
Toronto: Wilgress, 1916, 54 pp.
Report of the use of the scale at the institution for the feeble-minded at Waverly, Mass.
266. MANAHAN, J. L.: *A Bibliography of Educational Surveys and Tests*.
University of Virginia Record, Extension Series, Vol. 2, No. 3, Nov., 1916, pp. 49-92.
Mental tests included.
267. MANGOLD, G. B.: *Problems of Child Welfare*.
N. Y.: Macmillan, 1914, 522 pp.
A discussion of the results of Binet testing.
268. MARTIN, A. LEILA: *Note on the Training of Teachers to Use the Binet Scale*.
Training School Bull. 1915, 12: 68-69.
A second confirmation of the fact that teachers can be taught to use the scale with surprising accuracy in a six-weeks' thorough summer school course. (See reference 140 in earlier bibliography.)
269. MARTIN, A. LEILA: *Experiments with Binet-Simon Tests upon African Colored Children, Chiefly Kaffirs*.
Training School Bull. 1915, 12: 122-123.
Thirteen cases, ages 4 to 18. Nine children (under eight years chronologically) tested at age, or within one year of it.
270. MARTIN, A. LEILA: *A Contribution to the Standardization of the DeSanctis Tests*.
Training School Bull. 1916, 13: 93-110.
Correlation of Binet age with performance in this test. Concludes that these tests are valuable as a supplementation to the Binet, or for use in a parallel scale.
271. MARTIN, J. T.: *The New Colony Plan for the Feeble-minded*.
Proc. Nat. Conf. Char. and Corr. 1916, pp. 239-250; also Jour. of Psycho-Asthen. 1916, 21: 25-35.
The introduction of the Binet tests into this country by Goddard are shown to have initiated a new era in the understanding and treatment of the feeble-minded.
272. MARTIN, J. T., WEBB, E. E., BALL, E. V., COGHILL, H. D., PRIDDY, A. S., DREWRY, W. F., AND HOKE, K. J. *Mental Defectives in Virginia*.
Richmond, Va.: Davis Bottom, 1915, 128 pp.

The results obtained from the examination of 743 children in the public schools of Richmond and the provision made for the subnormal in special classes are discussed. See article by Hoke.

273. MAXWELL, W. H.: *A Message*.
Ungraded, 1915, 1: 1-3.
Advises use of the scale by regular class teachers before a child's deficiency is reported to the principal.
274. MELVILLE, N. J.: *An Organized Mental Survey in Philadelphia Special Classes*.
Psychol. Clinic 1916, 9: 258-265.
Examined 850 special class pupils by the 1911 Binet revision. Finds scale of value for grading, and for the study of delinquency and feeble-mindedness.
275. MELVILLE, N. J.: *Further Suggestions Regarding Mentality Tests*.
Jour. of Educ. Psychol. 1916, 7: 429-431.
Outlines what have been the underlying bases for the various criticisms of the scale, and suggests how to eliminate these defects.
276. MENDELSON, J. J.: *A Summary of Nervous and Mental Findings in Feeble-minded Children*.
In Health of School Children II, (taken from Illinois Med. Jour., Oct., 1914)
Bur. Educ. Bull. No. 50, 1915, pp. 157-161.
295 cases segregated at the Lincoln (Ill.) State School and Colony graded by the scale. Findings: 50 idiots ages 3 to 31; 125 imbeciles ages 6 to 43; 84 morons ages 11 to 48; 24 backward; and 11 normal.
277. *Mentality Tests: A Symposium*. (C. E. SEASHORE, R. M. YERKES, J. R. ANGELL, W. V. BINGHAM, H. H. GODDARD, F. N. FREEMAN, T. H. HAINES, W. HEALY AND A. F. BRONNER, H. L. HOLLINGWORTH, H. D. KITSON, F. KUHLMANN, J. B. MINER, W. H. PYLE, L. M. TERMAN, C. H. TOWN, J. E. W. WALLIN, G. M. WHIPPLE, M. R. TRABUE, N. J. MELVILLE, H. T. WOOLLEY.)
Jour. of Educ. Psychol. 1916, 7: 163-166, 229-240, 273-286, 348-360, 427-433.
For annotations see separate author headings.
278. METTLER, L. H.: *The Diagnosis of the Borderland Psychoses: A Warning*.
Archives of Diagnosis, 1915, 8: 329-339.
Dangers in the use of the scale with borderline subjects.
279. MEUMANN, E.: *Abriss in der experimentellen Pädagogik*.
Lpzg.: Engelmann, 1914, 462 pp.
280. MINER, J. B.: *The Scientific Study of Juvenile Delinquents in Minneapolis*.
Jour. of Crim. Law and Criminol. 1913, 3: 781-783.
An outline of the work and a description of the methods used.
281. MINER, J. B.: *A Percentage Definition of Intellectual Deficiency*.
Paper read before Amer. Psychol. Assoc., Chicago, Dec., 1915.
282. MINER, J. B.: *Mentality Tests: A Symposium*. (See earlier reference.)
Jour. of Educ. Psychol. 1916, 7: 282-284.
In constructing a scale would "prefer to choose tests, the results with each of which could be scored with continuous units." Percentile gradation "should become a fundamental principle in the construction of developmental scales." Variation would then be expressed in percentile terms. Advises construction of supplementary scales.

283. MITCHELL, D.: *Schools and Classes for Exceptional Children*.
Cleveland: Cleveland Foundation, 1916, 122 pp.
In the chapter on the selection of the feeble-minded the following is included:
what are the Binet tests, the use of the Binet tests, the use of the tests in Cleveland, who should make the mental tests and the organization of a Division for Examinations.
284. MORGAN, BARBARA SPOFFORD: *The Backward Child*.
N. Y. and London: G. P. Putnam's, 1914, 263 pp.
In outlining a scheme for mental diagnosis it is stated that some of the Binet tests were "selected as bringing into play the mental faculties which must be analyzed."
285. MOULTON, A. B.: *Wassermann Tests: Six Hundred Cases of Feeble-minded at the Minnesota School for Feeble-minded and Colony for Epileptics*.
Jour. of Psycho-Asthen. 1914, 18: 222-226.
The mental ages of the subjects whose reactions were positive, weak positive, very weak positive, or faint or doubtful, are given.
286. NEUSTADT, R. M., AND STATE COMMISSION: *Report of the Commission to Investigate Provision for the Mentally Deficient*.
Albany: J. B. Lyon Co., 1915, 628 pp.
The scale used in various surveys throughout the state.
287. NEWKIRK, H. D.: *On the Diagnosis of Feeble-mindedness*.
Jour. of Crim. Law and Criminol. 1913, 4: 278-280.
The scale should not be used as the sole standard in diagnoses. Dangers of error.
288. OLSON, H.: *The Psychopathic Laboratory Idea*.
Jour. of Crim. Law and Criminol. 1915-1916, 6: 59-64.
The work of the Chicago Municipal Court Laboratory explained, 85% of Boys' Court and Morals Court cases feeble-minded.
289. ORDAHL, GEO.: *A Study of Fifty-three Male Convicts*.
Jour. of Delinq. 1916, 1: 1-21.
Inmates of Joliet penitentiary (Ill.). Range of mental age from 6 to 16. Range of I. Q. from 41-106. Correlations between school grade and mental age. Case studies.
290. ORDAHL, G.: *A Study of 341 Delinquent Boys*.
Jour. of Delinq. 1916, 1: 72-86.
Inmates of the St. Charles School for Boys (Ill.). About 20% feeble-minded. Grades reached, types of delinquency and individual cases discussed.
291. ORDAHL, LOUISE E., AND ORDAHL, G.: *Qualitative Difference Between Levels of Intelligence in Feeble-minded Children*.
J. of Psycho-Asthen. Monogr. Suppl., Vol. I, No. 2, June 1915, 50 pp.
Thirty cases studied, children of mental levels 6, 8, and 10. Chronological ages between 15 and 35. Fifteen tests utilized. Interesting qualitative differences found.
292. OTIS, A. S.: *Some Logical and Mathematical Aspects of the Measurement of Intelligence by the Binet Scale*.
A thesis presented to the Department of Education, Leland Stanford Univ., May, 1915, 57 pp.
Also Psychol. Rev. 1916, 23: 129-152, 165-179.

A masterly discussion of the mathematical and statistical bases underlying the placement of tests in the various ages. Indicates how the final probable intelligence of a child may be predicted on the basis of growth curves, and how a scale may be constructed in which equal increments shall actually measure equal increments in intelligence development.

293. OTIS, A. S.: *Heredity and Mental Defect*.

J. of Delinq. 1916, 1: 87-100, 125-128.

An attempt to reconcile prevailing views regarding the inheritance of mental defect. The nature of intelligence discussed.

294. OTIS, MARGARET: *Moral Imbecility from a Respectable Family*.

Psychol. Clinic 1915, 9: 51-55.

The application of the scale to a girl of "normal intelligence" who is characterized as a "moral imbecile."

295. OTIS, MARGARET: *A Study of Association in Defectives*.

J. of Educ. Psychol. 1915, 6: 271-288.

Correlation of Binet mental age with association responses of defectives and normals.

296. PARKER, SARAH W.: *The Outlook for James: A Clinic Teacher's Report*.

Psychol. Clinic 1916, 10: 71-87.

Analysis of the boy's reactions to the Binet scale.

297. PETERS, A. W., AND BLACKBURN, L.: *Experimental and Clinical Studies on Mental Defectives. I*.

J. of Lab. and Clinical Med. 1915, 1: 180-188.

The use of physio-chemical data in diagnoses to supplement Binet testing.

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VOLUME VIII

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EDITORIAL

The New Hampshire state bureau of educational research, established and maintained by the General Education Board, but organized under the administration of the state superintendent of public instruction, has achieved noteworthy results in the hands of its energetic director, Mr. H. A. Brown. These are set forth in the recent annual report of the state superintendent. The general aims of the bureau are the demonstration of the social needs to be met by the school, the formulation of courses to meet these needs, and the development of methods to make the courses effective. Specifically, the bureau has carried on five different lines of investigation:

1. Nearly four thousand pupils were tested for their ability in silent reading, and the results arranged as norms readily used by teachers and superintendents. Striking differences in the reading ability of pupils in the same class were revealed, and the question is raised whether it is not worse than futile to attempt simultaneous instruction with such heterogeneous material. School systems of substantial equality in results differ widely in the amount of time devoted

to reading. Pupils were found in the third and fourth grades with as high reading capacity as pupils in the high school. Such pupils might well be excused from formal work in reading, and encouraged to devote their attention to other subjects in which they are less proficient. It would seem that ability to read is closely related to ability to study, and properly directed and supervised study is likely to enhance reading ability.

2. A beginning was made in the study of the social needs of arithmetic content. This is a large undertaking and will require much time and labor to complete. Perhaps there is no greater service that a state department could render than to make a thorough survey of each section of the state with regard to the resources available for material in arithmetic work. The published results of such a survey would be a mine of information for teachers, would tend to definitize the teaching of arithmetic, and would furnish a basis for determining the arithmetical materials needed in different vocations.

3. An extensive enquiry was made regarding the capacity of pupils to read thought from the Latin page after from one to four years' study of the subject in the high school. There seems to be little improvement after the second year, and ability at the end of the fourth year is meager out of all proportion to the time, energy and money devoted to Latin study and teaching. Pupils who have had little formal instruction in Latin grammar show greater ability to sense the significance of a grammatical construction than those who have had much formal drill in grammar. Latin instruction either has no effect upon or is a positive detriment to the clear, forcible, elegant use of English.

4. A similar study for French is not yet completed.

5. A study of methods in stenography compared the value of the direct method, in which pupils take meaningful notes from the beginning, with that of the formal method, where pupils spend months drilling on symbols before taking any dictation. This is still in progress.

Plans for future prosecution of the work include studies with different types of reading material; a study of transfer in spelling, which will take account of differences in technique of instruction; a study of the effect of different systems of handwriting upon the subsequent, uncontrolled handwriting of the pupils; and the development of a workable scale in English composition. It is to be hoped that the withdrawal of Mr. Brown to normal school work in a distant state will in no way interfere with the realization of these plans.

J. C. B.

NOTES AND NEWS

During the past summer the Food Conservation Bureau of the United States Food Administration in its efforts to get before the people its plans for economizing food stuffs has carried on a campaign of information in the summer schools of the country. A course of ten lessons in conservation was prepared, and 633 schools presented these lessons to their pupils. Over 50,000 copies of the lessons were supplied to teachers' institutes during August and September. The Bureau is now planning with the coöperation of the Bureau of Education to place in the schools a course of study which shall constitute an integral part of our educational aims. The Bureau of Education will publish, on the first of October and of each month thereafter up to June, a bulletin of family and civic economics. The material will be in the form of reading and study courses for elementary and high school grades, and will cover all the topics that enter into community life. These lessons will be prepared under the supervision of Professor Charles H. Judd, of the University of Chicago, and are intended to stimulate closer coöperation between the school and the community in solving the problems of our democracy.

The state health commissioner of Massachusetts has appointed as a committee on the conservation of child life, Drs. David L. Edsall and William J. Gallivan, members of the public health council, and Dr. Lyman A. Jones, director of the division of hygiene of the state health department. As consulting members he has named Drs. Fritz B. Talbot, pediatricist and chief of the children's medical department, Massachusetts General Hospital; Richard M. Smith, assistant in pediatrics, Harvard Medical School; Walter E. Fernald, superintendent of the Massachusetts School for the Feeble-Minded; William Healy, psychopathologist, Boston Juvenile Court; and Miss Mary Beard, director of the Instructive District Nursing Association.—*School and Society*.

The new University High School, maintained in connection with the department of education of the State University of Iowa, has adopted a six-year course of study. Pupils will be admitted who have passed the sixth grade of accredited schools, or who can show an equivalent degree of academic proficiency. The six-year plan was adopted to give greater unity to the work of elementary and secondary education, and to facilitate such arrangements for indi-

vidual instruction as to make it possible for bright pupils to complete the course in five years.

The following communication has been received from the chairman of the committee on examinations of the National Council of Teachers of English: "Though examinations share with text-books the responsibility of determining in very large measure the character of American education, yet little attempt has been made to standardize them. There will be general interest, therefore, in the announcement that a definite and systematic investigation has been authorized by the executive committee of the National Council of Teachers of English to determine the extent that examinations in English set by teachers and various educational authorities are a handicap to the progress of American schools. The committee responsible for this undertaking has prepared to conduct a thoroughgoing inquiry into practices with reference to examinations in English in the elementary schools, the junior and senior high schools, the junior colleges, and in normal schools, colleges and universities. The committee expects to study data obtained from teachers, publishers, and educational authorities, and to test the current practices of examiners in the light of present-day educational needs. A study will be made of the psychological basis of questioning and examining. Considerable thought will be given to the formulation of a philosophy of examining in English studies, and to the determination of definite objectives in testing the results of teaching." The committee bespeaks the interest and cooperation of readers of this JOURNAL. The chairman of the committee is C. C. Certain, Cass Technical High School, Detroit, Michigan.

The Bureau of Educational Experiments has recently issued a pamphlet setting forth the aims of the institution and its accomplishments during the first year of its existence. The Bureau is planned as a clearing house of educational ideas. Its purpose is to collect material that is concerned with the scientific study of education, and by publications and exhibits make it easily available to people who are interested. It gives support to present experiments, initiates new experiments, and endeavors to hasten the introduction of newly acquired methods through actual teaching experiments. Its work is divided into four departments: Department of teaching experiments, department of social, mental and physical experiments, department of information, and department of records and statistics. During the coming year it will undertake several new experimental classes and

through its departments will make an intensive study of all the pupils in these classes from the point of view of their social, mental and physical needs. Through this systematic observing and recording of children it hopes to arrive at a more satisfactory and accurate method of assessing the results of various school environments than has hitherto been possible. The Bureau has at its disposal funds which make possible a program of work extending over a term of years. Anyone desiring a more detailed statement of the aims and publications of the Bureau is invited to write to The Bureau of Educational Experiments, 70 Fifth Avenue, New York, N. Y.

The Milwaukee Teachers Association has sent to the school board a resolution asking for a survey of the Milwaukee schools.—*School and Society*.

The Hicks Series for Atypical Children, published by Milton Bradley Company, 20 Second Street, San Francisco, has been very favorably received in the northwest and on the coast. The series consists of educational games, simple readers, an action primer used as a game, number and geography story books. It is intended to be used with small normal children needing supplementary reading; with over-age, dull, backward and foreign children, whose reading ability does not keep pace with their social understanding; with inattentive and disorderly children, whose interests are manual rather than literary; and with subnormal and feeble-minded children, who fatigue quickly under sustained effort, and who need constant stimulation for any successful effort at all.

Dr. Charles Hughes Johnston, professor of secondary education in the University of Illinois, was killed in an automobile accident between Washington and Baltimore on September 4. Dr. Johnston was born near Chapel Hill, N. C., in December, 1877, and was thus not quite forty years old. Graduating from the University of North Carolina, he entered the Harvard psychological laboratory and carried on an investigation of the feelings under Muensterberg and Holt. In Harvard he also took courses in education, and in his service in the Universities of Michigan, Kansas and Illinois was influential in advancing the cause of psychological studies of educational activities. As editor of two important books on the high school he became identified with secondary education, and as managing editor of *Educational Administration and Supervision* he exerted a stimulating influence upon progressive school men.

Dr. Edward O. Sisson, formerly commissioner of education of Idaho, has accepted the presidency of the University of Montana.—*School and Society*.

Dr. William F. Russell, professor of secondary education at the George Peabody College for Teachers, has been elected dean of the college of education at the University of Iowa.—*School and Society*.

Alfred L. Hall-Quest, professor of secondary education in the University of Virginia, well known for his investigations on supervised study, has been appointed inspector of high schools and dean of the college for teachers at the University of Cincinnati.

Dr. Ernest H. Lindley, professor of psychology at the University of Indiana, known for his work on mental automatisms, psychology of puzzles, arithmetical prodigies, etc., has been called to the presidency of the University of Idaho.

Professor J. O. Creager, dean of the department of education at the University of Wyoming, has been appointed state commissioner of education for Wyoming.—*School and Society*.

At the University of Texas Dr. Clarence S. Yoakum has had his title changed from associate professor of philosophy to associate professor of psychology, and Mr. J. U. Yarbrough has been appointed instructor in psychology.

Dr. H. R. Crosland, of the department of psychology at the University of Minnesota, has been elected assistant professor of psychology in the University of Arkansas.

Dr. Percy Kendall Holmes, of the University of Cincinnati, has been appointed director of physical education in Ohio Wesleyan University.—*Science*.

Dr. C. Truman Gray (Ph.D., Chicago), instructor in the art of teaching at the University of Texas, has been promoted to the rank of adjunct professor in that institution.

PUBLICATIONS RECEIVED

AGNES RUSH BURR. *Russell H. Conwell and His Work*. Philadelphia: The John C. Winston Company, 1917. Pp. 438. \$1.35.

The hero of this biography started life as a penniless boy on a rocky New England farm, and became one of the most powerful speakers and most popular pulpit orators in America. Among the interesting episodes are his running away to Europe at the age of fifteen, working his way through Yale College, service in the Civil War, admission to the bar and career as a lawyer, his entrance into the ministry, the building of the Baptist Temple in Philadelphia, the founding of Temple University, and his success on the lecture platform. An appendix contains Dr. Conwell's famous lecture "Acres of Diamonds."

A. D. DARBISHIRE. *An Introduction to a Biology and Other Papers*. New York: Funk and Wagnalls Company, 1917. Pp. xviii, 291. \$2.50.

This book contains the fragments of an unpublished book and a number of papers scattered in obscure journals as a sort of memorial to the brilliant young biologist whose life was claimed a few months ago as a sacrifice in the great war. From the preface, written by his sister, we learn that the author began his biological career under the influence of the Biometric School at Oxford and thus took a hostile attitude towards the Mendelian School. Later in his book on "Breeding and the Mendelian Discovery" he endeavors to reconcile these two contending factions by showing that their differences are only apparent. In spite of flattering offers from America and Canada in 1915, he felt it his duty to enlist in the English army, and was carried off by meningitis after an illness of only one day. His philosophical ideas were strongly colored by Bergson, while many passages indicate the powerful influence which music exerted upon his thinking.

ARTHUR W. GILBERT. *The Potato*. New York: The Macmillan Company, 1917. Pp. xii, 318. \$1.50.

In these days of war, high cost of living and food famines, it is fitting that the attention of all thoughtful people should be directed to the production of food. The shortage in the last potato crop was keenly felt by the entire civilized world, and all over the country we have seen strenuous efforts made to secure the planting of the largest possible acreage of potatoes. The present work may be considered the official and authoritative account of the potato. The author, who is professor of plant breeding at Cornell University, has had the assistance of Professor Mortier F. Barrus, professor of plant pathology at Cornell and of Daniel Dean, formerly president of the New York State Potato Association, in the preparation of the book. Of all the food crops produced in the world, the potato heads the list with

161 million tons; corn comes second with 128 million tons; and wheat third with 106 million tons. Germany raises almost five times as many potatoes as the United States and has considerably over twice as large an average yield per acre. New York surpasses all other states in the production of potatoes but is closely followed by Michigan, Wisconsin and Minnesota. The potato is a native of Peru and Chile but was carried by explorers to Spain in the sixteenth century and thence spread rapidly over all Europe. The subsequent history of the potato forms a very interesting chapter in the world's food production. The book has an excellent discussion of potato breeding, climate, soils, fertilizers, planting, care of the growing crop, protection against insects, potato diseases, harvesting, marketing and storage. It is an invaluable book for potato raisers both amateur and professional.

HERMAN HARRELL HORNE. *Story-Telling, Questioning and Studying, Three School Arts*. New York: The Macmillan Company, 1916. Pp. 181. \$1.10.

While we ordinarily associate story-telling with the lower grades, questioning with the class recitation, and studying with more advanced educational work, the author claims that these are universal school arts,—a part of the technique of all teaching craft. They must be adapted to the age and needs of the pupil, and these chapters are designed to point the way to such adaptation. Under story-telling are considered such topics as the importance of the story, the characteristics of a good story, how to tell a story, the reactions of children to stories, and the place of the story in education. There are useful lists of books in which good stories may be found, books on how to tell stories, and lists of stories arranged by grades. The chapters on the art of questioning and the art of studying are written in the easy, informal style which has made the author so popular with groups of teachers.

NELS QUEVLI. *Cell Intelligence*. Minneapolis, Minnesota: The Colwell Press, 1916. Pp. 460. \$2.58.

This is a very interesting book, partly because of the wide reading of which it gives evidence, and partly on account of the attitude of the author toward his central thesis. This thesis may perhaps be best expressed in the words of the sub-title, "The Cause of Growth, Heredity and Instinctive Actions, Illustrating that the Cell is a Conscious, Intelligent Being, and, by Reason thereof, Plans and Builds all Plants and Animals in the Same Manner that Man Constructs Houses, Railroads and other Structures." It will be seen that we here have to do with vitalism of an extreme type. The cell is conceived not only as a life principle, but as endowed with the purposeful foresight of a human being. Such a faith would be quite ridiculous (most biologists will probably consider it ridiculous in any case) if it were not for the fact that the author shows considerable

familiarity with and quotes liberally from such standard authorities as Wilson, Haeckel, Jennings, Mast, Driesch, Morgan, Loeb and Verworn. The author is tremendously in earnest and believes that this view of the cell as the source and directive agent of all life activities furnishes a key by which we may read the riddle of the universe. The book is written for the plain man, and the author is endeavoring to give it the widest possible circulation. While we cannot agree in attributing intelligence to single cells, we are convinced that any one who reads the book will have a much better understanding of the way in which animal species are interrelated.

MARY E. RICHMOND. *Social Diagnosis*. New York: Russell Sage Foundation, 1917. Pp. 511.

This is the most elaborate and scientific analysis of the activities of social workers that has yet been published. It is the result of fifteen years' experience in active social work, and has grown up under the stimulus of various courses of lectures delivered to social workers. Part I, on social evidence, deals with the history of social work, the types and uses of social evidence, definitions of certain terms frequently met with, kinds of evidence, and on the significance of inference in social investigation. Part II describes and evaluates the various processes leading to diagnosis. Here we find a careful consideration of the first interview, of the impression produced by the family as a whole, the utilization of outside sources of data, the arguments for and against seeking the help of relatives, the assistance that may be derived from medical examination, the support of teachers, employers, and fellow workers, the use of documentary data, such as directories and newspaper files, neighborhood sources, public officials and fraternal orders, social agencies, letters and telephone messages. Part III gives detailed accounts of the diagnosis and treatment of such special cases as the immigrant family, the deserted or bereft family, the neglected child, the unmarried mother, the homeless and inebriate, the blind, and the feeble-minded. Appendices present samples of first interviews, statistics of outside sources, and a brief working bibliography. All social workers and many teachers would profit by a careful study of this book.

MARY SWARTZ ROSE. *Feeding the Family*. New York: The Macmillan Company, 1917. Pp. xvii, 449. \$2.10.

"While many things contribute to health (sleep, fresh air, and exercise, for instance) the foremost consideration is food. This is recognized as never before, and those who regard their own welfare and desire to give their children the best possible equipment for the stress of modern life are asking how to choose food wisely. The purpose of the author has been to provide such a little book for the numerous housewives who prepare something like a thousand meals a year for their families, and who wish to know how the science of nutrition can be made to function most successfully in their daily lives." There are two very sensible chapters on "The Significance

of Food" and "Care of the Digestive Mechanism," followed by specific recommendations in regard to food for the adult man and woman, for the baby, and for children at various ages. The chapters are well written and give a clear account of the food values of different edibles. In an appendix an elaborate table is presented of the nutrition value of different foods and beverages.

WILLIAM BERRYMAN SCOTT. *The Theory of Evolution, with Special Reference to the Evidence Upon Which it is Founded.* New York: The Macmillan Company, 1917. Pp. ix, 183. \$1.00.

Intelligent people and even scientists are often confused by the claim that the doctrine of evolution is no longer accepted by the leaders of biological science. Such statements are due to the purposeful or unwitting confusion of Darwinism with evolution, and to the assumption that failure to accept Darwin's views of the potency of natural selection involves the rejection of the whole evolutionary conception. The author shows, however, that never has the general doctrine of evolution been more firmly grounded upon the basis of scientific fact, and more universally accepted by scientific students. In simple, popular language, the author discusses the present status of the question of evolution, and marshals the evidence for the theory derived from embryology, from paleontology, from geographical distribution, and from direct experiment. It is a valuable and convincing book for the intelligent layman and for the young student.

WILLIAM ENGLISH WALLING, and others, Editors. *Socialism of Today.* New York: Henry Holt and Company, 1916. Pp. xvi, 642. \$1.60.

In these days of labor unions, of manufacturers' organizations, of coöperative associations for the distribution of farm products, and, of the increasing demands for the public control of public utilities, the traditional stigmatism attaching to the term "socialism" is fast disappearing. Everybody seems to be a socialist in some sense, and the chief differences lie in the kind and amount of socialism professed. Under these circumstances the appearance of the present handbook of socialist beliefs is timely. Part I gives a survey and brief history of the socialist parties of the world, beginning with the international socialist movement, and including the chief national movements on the continent, in the United States and Canada, and in the British Empire. It is true that the present war has so profoundly influenced the thought of European socialists that many of the views here expressed could scarcely be said to be representative at the present time. These changes of opinion are discussed in a companion volume, "Socialism and the War." Part II presents the attitude of socialist parties toward such questions as labor unions, the general strike, compulsory arbitration, the cost of living, agriculture and the land problem, government ownership, immigration and the race problem, the drink question, woman suffrage, and education. The book will be found a useful and authoritative compendium of political socialism throughout the world.

CHANG PING WANG. *The General Value of Visual Sense Training in Children*. Educational Psychology Monographs, No. 15. Baltimore: Warwick and York, Inc., 1916. Pp. vii, 85. \$1.00.

In view of the extravagant claims recently made in educational literature for the value of visual sense training both in kindergarten and in secondary education the present experimental investigation of the subject on groups of children should attract attention. The subjects were 22 children from nine to twelve years of age, and from grade III, A to V, B. These were divided into two groups of approximately equal ability, one the trained, the other the untrained group. Several of the pupils were obliged to drop out of the experiment before its completion, so that complete records were obtained from only 13 pupils. The training was in the discrimination of the lengths of vertical lines, and was continued for forty-eight periods, extending over fourteen weeks. The results show a slow increase in accuracy of discrimination accompanied by a considerable increase in reaction time. The test experiments included discrimination of pitch, of shades of color and of size. There was no evidence of transfer except in the case of the latter, and here the transfer was greatest when the situation most closely resembled that of the training situation. In another experiment on the marking of letters the improvement consisted in carrying over the methods that had been developed in the training series. On the whole, then, there seemed to be no visual sense training in the process, but some increase of caution in pronouncing judgment, and a considerable transfer of method from one kind of problem to another.

JEAN WEIDENSALL. *The Mentality of the Criminal Woman*. Educational Psychology Monographs, No. 14. Baltimore: Warwick and York, Inc., 1916. Pp. xx, 332.

The essence of the old attitude toward criminals was revenge, that of the new is protection for society. One type of protection is secured by rendering the criminal innocuous, another by changing him into a useful and productive member of society. Either type, but especially the latter, calls for a thorough and intensive study of the criminal, in order to determine the grounds for his anti-social behavior, and thus render possible his re-education and reformation. The new penology, therefore, calls upon the resources of psychology at every step, and is giving rise to psychological studies of law-breakers all over the country. The present study is one of the most complete and detailed that has yet been made of the criminal woman. The author, who was formerly director of the department of psychology in the laboratory of social hygiene at the Bedford Hills Reformatory, New York, has indicated the scope of the investigation in the subtitle of the book: "A Comparative Study of the Criminal Woman, the Working Girl, and the Efficient Working Woman in a Series of Mental and Physical Tests." The groups tested consisted of 88 inmates of the Bedford Reformatory and eighteen efficient college

maids. The tests used were the Woolley Tests from the Bureau of Vocational Guidance in Cincinnati, supplemented by tests of writing, reading, following directions, mirror tracing, memory, and puzzles. There was thus available for comparison a considerable body of results from the Cincinnati studies. The book presents a mass of valuable material in the form of tables and illustrative charts—material that will repay careful study by all those interested in mental testing. In common with other investigators the author finds this type of criminal woman characterized by a rather low mentality and marked emotional instability.

CLEMENT C. J. WEBB. *Group Theories of Religion and the Religion of the Individual*. New York: The Macmillan Company, 1916. Pp. 208

This is a course of lectures delivered by the author as Wilde Lecturer on Natural and Comparative Religion in the University of Oxford. The author presents in detail his understanding of the sociological theories of religion advocated by a group of prominent French sociologists, and then subjects these theories to a careful and penetrating philosophical analysis. In their emphasis upon religion as a social or group phenomenon the author thinks that these writers (in common with William James and other American students of the subject) have failed to give due weight to the feeling of need on the part of the individual.

JAMES WELTON. *Principles and Methods of Teaching*. Seventh Impression. Baltimore: Warwick and York, Inc., 1916. Pp. xxv, 667. \$1.65.

This is an encyclopedic work on methods in teaching. After introductory chapters on the functions of the teacher, the material of instruction, and the form of instruction, there follow chapters on such specific subjects as the teaching of reading, literature, composition, grammar, music, history, geography, science, mathematics, manual training, and needle work. There is an appendix of 100 pages on the teaching of modern languages.

CLIFFORD WOODY. *Measurements of Some Achievements in Arithmetic*. Teachers College Contributions to Education, No. 80. New York: Teachers College, Columbia University, 1916. Pp. 63. \$1.00.

"The purpose of this monograph is to set forth the results of an attempt to derive a series of scales in the fundamental operations of arithmetic. Each of the scales is composed of as great a variety of problems as the fundamental operations can well permit. These problems, beginning with the easiest that can be found, gradually increase in difficulty until the last ones in each series are so difficult that only a relatively small percentage of the pupils in the eighth grade are able to solve them correctly. In the determination of the relative difficulty of these problems, the relative per cents of correct answers obtained by submitting them to large numbers of school children were taken as a basis."

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THE MEASUREMENT OF ABILITY IN LATIN. PART I. VOCABULARY

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A recent writer¹ on the psychology of language instruction points out the diversity of opinion and the uncertainty which prevail in this field. The reasons for this state of affairs are not far to seek. Problems that arise are solved on a basis of mere opinion or of practical experimentation which is unreliable, ambiguous and unconvincing. Flagstad rightly maintains that the great need is an exact scale for the measurement of results of instruction, which will make possible reliable quantitative comparisons. While many would recognize the desirability of such a scale, the great majority perhaps would question the possibility of its construction. The results to be given in this study represent an attempt to secure such a scale.

Ability in a foreign language may be indicated in three main ways: (1) Scope and accuracy of vocabulary; (2) Ability to understand connected discourse in a foreign language, or, rate and accuracy of translating from a foreign language to the mother tongue, or, from the mother tongue to the foreign language; (3) Knowledge of grammar, syntax, and word derivation. Each or all of these abilities are available for purposes of measurement and are capable of measurement. The present paper will report work done to measure ability in Latin in one of these directions. It will give results from two vocabulary tests—an "Easy Vocabulary Test" (for first-year Latin pupils), and what I shall call "A Standard Vocabulary Test." A subsequent paper will

¹ FLAGSTAD, CHR. B. *Psychologie der Sprachpädagogik*. Leipzig und Berlin, 1913, Vorwort, s. v.

report a study of ability to translate as measured by a sentence test based upon the Standard Vocabulary. Similar studies of ability in German are in progress. For coöperation and assistance in developing these tests I am indebted to many teachers of Latin the country over, the list of which is too long to be given here. I am under especial obligations to Mr. H. A. Brown, Director of the Bureau of Research, Department of Public Instruction, Concord, New Hampshire, and to Dr. Walter S. Monroe, Director of the Bureau of Educational Measurements and Standards, Kansas State Normal School, Emporia, Kansas, for providing an opportunity to give the tests in New Hampshire and Kansas, respectively. Without the interested coöperation of Latin teachers, such a study as this would be impossible.

EASY VOCABULARY TEST

The most obvious evidence of ability and progress in Latin is in the number of Latin words whose meanings are known or whose equivalents in English can be given. Other things being equal, then, the pupil that makes the best score in a vocabulary test will show the highest ability in Latin or will have made the most progress. The essential difficulty in the construction of satisfactory tests lies in the selection of the words to be used. If results are to be comparable beyond the limits of a single class or of classes using the same texts, they should necessarily be such as the pupil has come in contact with and might reasonably be expected to know. The variety of first year texts and the great variation in vocabularies, in spite of the growing tendency to make the first year book introductory to Caesar, and to select the vocabulary from Caesar, make the determination of a satisfactory list of words difficult. Preliminary experimentation begun five years ago was based on a hundred words, fifty in Latin and fifty in English. These words were found to be common to four first-year books, widely used, according to the testimony of Latin teachers; namely, the first-year texts of Collar and Daniell, D'Ooge, Pearson, and Smith and Laing. Subsequent study showed that these words are, with few exceptions, common to twelve of the most recent or commonly used first-year texts. Following is a list of these words as they were given:

Latin Vocabulary Test

1.

1. adventus
2. caput
3. cur
4. dominus
5. pilum
6. auxilium
7. civis
8. de
9. equitatus
10. finis
11. fugio
12. gero
13. homo
14. ignis
15. proelium
16. incolo
17. pedes
18. impetus
19. ad
20. domus
21. pulcher
22. inter
23. diu
24. conficio
25. ante

26. interficio
27. legatus
28. magister
29. laboro
30. mille
31. parvus
32. malus
33. neque
34. maneo
35. omnis
36. maximus
37. primus
38. maior
39. par
40. oppugno
41. post
42. relinquo
43. supero
44. trans
45. occido
46. sequor
47. recipio
48. venio
49. vinco
50. proximus

2.

1. farmer
2. high
3. camp
4. speed
5. abundance
6. leader
7. I give
8. the other
9. horse
10. flight
11. I hear
12. sword
13. good
14. dear
15. horseman
16. grain
17. son
18. I throw
19. place (N)
20. king
21. I see
22. easy
23. I order
24. I say
25. war

26. broad
27. hand
28. free
29. much (adj.)
30. I praise
31. better (adj.)
32. I fortify
33. sailor
34. hostage
35. gate
36. foot
37. smaller
38. ship
39. girl
40. through
41. forest
42. always
43. without
44. I hold
45. city
46. life
47. I make
48. I wound
49. more
50. I call

The lists were given in June to 252 first-year pupils in ten schools, the Latin list first and then the English list. The time required varied from three to fifteen minutes. The results for the different schools in terms of the median number of words correct are indicated in the following table.

TABLE I.

Latin Vocabulary Test—100 Words

Median Scores for 252 First Year Pupils in 10 Schools

School	Latin-English	English-Latin
A	45	41
B	44	37
C	41.5	34.5
D	41.5	31.5
E	41	36
F	41	32
G	36	33.5
H	34	34
I	34	29
J	21	19
Median	41.5	35

The striking thing about this table is the great variation shown in the first year classes in ten very good high schools from a score of 45 or 90 percent correct to 21 or 42 percent correct in the Latin-English list, and from 41 or 82 percent to 19 or 38 percent in the English-Latin list. Such variability has frequently been shown in recent years with the application of standard tests and scales and needs no special comment. One is led to wonder, however, at the character and worth of the instruction in Latin where after a year's work 17 pupils on the average missed 29 out of 50 words as easy as those in the Latin-English list.

The distribution of the 252 pupils in each of the tests is indicated in Figs. 1 and 2.

The teachers were requested to mark on the papers the final grade in Latin for the year. In order to determine the validity and value of a vocabulary test as a measure of ability and progress the correlations between performances in the tests and the final grade were calculated for eight schools. Correlations were also determined between the performances in the two tests. These results appear in Table II.

TABLE II.

School	No. of Pupils	Latin-English and Marks	English-Latin and Marks	Latin-English and English-Latin
A	71	.64	.49	.82
B	44	.48	.52	.83
C	36	.59	.75	.92
D	17	.61	.77	.75
E	28	.26	.67	.88
F	7	.26	.68	.94
G	22	.77	.51	.49
H	11	.83	.90	.94
—	Average	.56	.66	.82

LATIN VOCABULARY TEST

LATIN - ENGLISH
(252 First Year Pupils)

Median Score 41.5

A	45	H	34
B	44	I	34
C	41.5	J	21
D	41.5		
E	41		
F	41		
G	36		

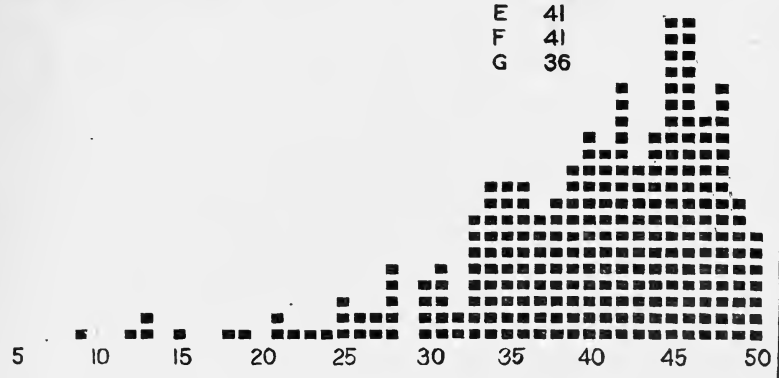


FIGURE I

LATIN VOCABULARY TEST

ENGLISH - LATIN
(252 First Year Pupils)

Median Score 35

A	41	H	34
B	37	I	29
C	34.5	J	19
D	31.5		
E	36		
F	32		
G	33.5		

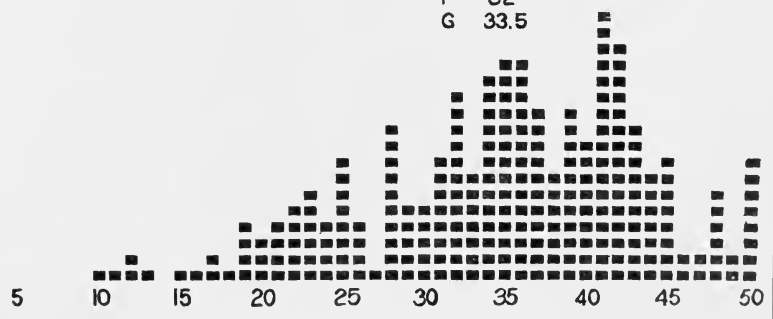


FIGURE II

The correlations, except in two instances, show a tolerably close agreement between scores and teachers estimates and indicate the usefulness of the tests in rating pupils. The correlations between the two tests are very high and show that either test could be used alone without much error.

ARRANGEMENT OF WORDS IN ORDER OF DIFFICULTY AND THE DETERMINATION OF SCALE VALUES

The scores and correlations above have been determined on the supposition that all of the words are of equal difficulty, which is obviously not true. In scoring a test such as this allowance should be made somehow for the fact that in the same list *pulcher* was correctly given by 99 percent of the 252 pupils while *omnis* was correctly given by 87 percent and *pedes* by 55 percent. To give these words equal values is of course inaccurate. A scale value for each word was determined by the method used by Buckingham,² in scaling words for spelling. At first blush it might appear as if the values could be determined directly from the percentages of times a word was translated correctly but this fails to take into account the form of distribution of mental abilities. Assuming that ability in translating these words follows the normal distribution then the difference of 2 percent between words remote from the median in the curve of distribution, such as *trans* 95 percent correct and *legatus* 93 percent is not the same as the difference between *par* 64 percent correct and *occido* 62 percent correct, though in both pairs the difference is 2 percent. On the assumption of the normal distribution the difference in difficulty between *trans* and *legatus* is about three times as great as that between *par* and *occido*. Pupils so poor in the knowledge of Latin after a year's work as to miss *trans* and *legatus* are far less numerous than those who would miss *par* and *occido*. The percentages of times each word is translated correctly being known, it is possible to locate the 50 words on the base line of a normal frequency surface in terms of the probable error equivalents of these percentages. In order to have a point of reference which would represent an approximation to a zero point in ability, a word, if there were one, so easy that it would be missed by but 5 out of 1000 first year pupils, was arbitrarily

² BUCKINGHAM, B. R. *Spelling Ability—Its Measurement and Distribution*. Columbia University Contributions to Education, New York, 1913.

taken as a point of reference. This point will be found to be 3.8 times the probable error below the median. A word so difficult that it would be given correctly by but 5 out of 1000 pupils would be located at a point 3.8 P. E. above the median. If the 3.8 P. E. is taken as the zero point then the more difficult word would have a value of 7.6. On such a scale the easiest word in the list, *pulcher*, would have a value of .3 while the most difficult would have a value of 5.2. Tables IV and V give the list of words in order of difficulty, the number of times each word was correctly translated, the percent of times correct, and the corresponding P. E. values subtracted from 3.8 P. E.

The two lists may be used by teachers and supervisors in testing first-year pupils in various ways:

1. The lists may be given as they stand without reference to variation in difficulty of the words, *i. e.*, without reference to the scale values. Comparisons may be made with the scores obtained in ten schools as shown in Table I.

2. The lists may be given as they are and the appropriate values or weights may be assigned to each word in scoring the results. The giving of varying weights to different examination questions is a familiar practice among teachers. The weights given in such cases are based merely on the teacher's judgment as to the amount of credit to be given. The weights assigned here have been scientifically determined on a basis of actual pupil performance in a sufficiently large number of cases to possess a very considerable reliability. A perfect score in the Latin-English list would be 125.5 points. Toward this score the pupil would be given 1.4 points for correctly translating *domus*, 2.8 points for *interficio*, and 3.6 points for *pedes*. Such scoring would be far more equitable than to give each word the same value.

3. A smaller list of words differing in difficulty by equal steps may be selected. For ready comparison, of a large number of schools and pupils such a list would be useful. A ten-word list of this nature would be *proelium*, 1.2, *magister*, 1.5, *ante*, 1.8, *de*, 2.1, *ignis*, 2.4, *dominus*, 2.7, *recipio*, 3.0, *par*, 3.3, *pedes*, 3.6, *incolo*, 4.1.

4. A smaller list, say of 20 words, *caput* to *recipio*, where the differences in values are so small that they can be neglected without great error would be useful for many testing purposes and simplify the problem of scoring.

TABLE IV.

Latin-English Words in Order of Difficulty and Their P. E. Values Subtracted from 3.8 P. E.

	No. Cor.	Percent Cor.	Scale Value
1. pulcher.....	250	.99	0.3
2. parvus.....	244	.97	1.1
3. proclium.....	241	.96	1.2
4. laboro.....	240	.95	1.4
5. trans.....	239	.95	1.4
6. domus.....	239	.95	1.4
7. magister.....	236	.94	1.5
8. legatus.....	234	.93	1.6
9. auxilium.....	233	.92	1.7
10. malus.....	230	.91	1.8
11. ante.....	230	.91	1.8
12. venio.....	230	.91	1.8
13. ad.....	229	.91	1.8
14. primus.....	227	.90	1.9
15. post.....	225	.89	2.0
16. caput.....	224	.89	2.0
17. finis.....	222	.88	2.1
18. de.....	220	.87	2.1
19. omnis.....	220	.87	2.1
20. inter.....	216	.86	2.2
21. mille.....	214	.85	2.3
22. oppugno.....	214	.85	2.3
23. civis.....	212	.85	2.3
24. eur.....	211	.84	2.3
25. fugio.....	211	.84	2.3
26. ignis.....	210	.83	2.4
27. equitatus.....	199	.79	2.6
28. maximus.....	198	.78	2.6
29. homo.....	196	.77	2.7
30. dominus.....	194	.77	2.7
31. interficio.....	189	.75	2.8
32. gero.....	187	.74	2.8
33. vinco.....	181	.72	2.9
34. neque.....	181	.72	2.9
35. recipio.....	175	.69	3.0
36. relinquo.....	170	.67	3.1
37. impetus.....	170	.67	3.1
38. sequor.....	168	.67	3.2
39. pilum.....	167	.66	3.2
40. diu.....	165	.65	3.2
41. par.....	162	.64	3.3
42. adventus.....	160	.63	3.3
43. supero.....	159	.63	3.3
44. occido.....	157	.62	3.3
45. maior.....	142	.56	3.6
46. pedes.....	139	.55	3.6
47. maneo.....	135	.53	3.7
48. incolo.....	102	.40	4.1
49. proximus.....	95	.38	4.2
50. conficio.....	42	.17	5.2

TABLE V.

English-Latin Words in Order of Difficulty and Their P. E. Values Subtracted from 3.8 P. E.

	No. Cor.	Percent Cor.	Scale Value
1. farmer.....	244	.97	1.1
2. girl.....	236	.93	1.6
3. good.....	234	.92	1.7
4. king.....	233	.92	1.7
5. war.....	232	.92	1.7
6. I see.....	229	.91	1.8
7. I hear.....	228	.90	1.9
8. I praise.....	216	.86	2.2
9. I call.....	216	.85	2.3
10. sailor.....	215	.85	2.3
11. I make.....	213	.84	2.3
12. camp.....	210	.83	2.3
13. son.....	208	.82	2.4
14. leader.....	207	.82	2.4
15. I give.....	207	.82	2.4
16. high.....	206	.82	2.5
17. city.....	203	.80	2.6
18. hand.....	201	.80	2.6
19. I order.....	199	.79	2.6
20. forest.....	195	.77	2.7
21. I wound.....	194	.77	2.7
22. I say.....	194	.77	2.7
23. horse.....	194	.77	2.7
24. dear.....	192	.76	2.8
25. grain.....	183	.73	2.9
26. gate.....	182	.72	2.9
27. sword.....	174	.69	3.0
28. much (adj.).....	169	.67	3.1
29. broad.....	166	.66	3.2
30. better (adj.).....	160	.64	3.3
31. place (N).....	159	.63	3.3
32. I fortify.....	158	.63	3.3
33. through.....	157	.62	3.3
34. free.....	153	.61	3.3
35. foot.....	147	.58	3.5
36. easy.....	143	.57	3.5
37. I hold.....	141	.56	3.6
38. I throw.....	137	.55	3.6
39. ship.....	133	.53	3.7
40. always.....	133	.53	3.7
41. like.....	132	.52	3.7
42. abundance.....	132	.52	3.7
43. flight.....	123	.49	3.8
44. more.....	119	.47	3.9
45. without.....	113	.44	4.0
46. smaller.....	104	.41	4.1
47. hostage.....	91	.36	4.3
48. horseman.....	91	.36	4.3
49. the other.....	89	.35	4.3
50. speed.....	74	.29	4.6

147.9

STANDARD VOCABULARY TEST

Experience with the hundred words reported above had seemed to show the value of a vocabulary test for many purposes—the rating of pupils, comparison of schools and teachers, a study of methods, etc.; hence, a further study of vocabularies was made. This was done partly to secure a larger list of words and partly because of the fact that occasionally teachers returned the first year lists with certain words marked as not occurring in the texts which they used. In order to overcome this difficulty and to secure a true standard vocabulary a tabulation was made of all the words occurring in thirteen recent or widely used beginners' books. The vocabularies in these books ranged from 750 to 1750 words. The total number of different words found in all the books was 3350. Of these 319 were common to all the books. Using Lodge's³ tabulation of all the words used in Caesar, Cicero, and Vergil, and their frequency of occurrence, all of the words of the 319 that are not used by all three of these authors were dropped. This reduced the list to the 239 words which form the basis of this study. This list of words would seem to be in the real sense a standard vocabulary for high school Latin. While the words will vary in frequency of use in the different books, all pupils, no matter what books are used, will have come in contact with them in their first year and will continue in contact with them throughout the four years of high school Latin.

Blanks containing the words arranged in alphabetic order were printed and have been used for various purposes during the past two years in a considerable number of schools. In the interest of economizing space in this article the blank is not reproduced. The list appears in Table VII below. For the information of Latin teachers and students of education the 80 words, which were dropped on the ground that they did not appear in Caesar, Cicero, and Vergil, are worth publishing. They are the following:

acriter	intellego	pons
agmen	interficio	porto
amicitia	iste	prope
animal	itaque	provincia
bene	legatus	proximus
captivus	legio	quidam

³ LODGE, GONZALEZ. *The Vocabulary of High School Latin*. Columbia University Contributions to Education, New York, 1907.

celeritas	liber	quinque
celeriter	liberi	quo
civitas	libero	reliquus
collis	magis	ripa
convoco	maxime	septem
cornu	minor	septimus
decimus	minus	sex
dissimilis	mons	silva
ducenti	moror	statim
duodecim	multitudo	sub
equitatus	natura	summus
equus	nolo	superior
expugno	numen	sustineo
facile	obses	trans
filia	oppidum	transeo
flumen	optimus	ultimus
fortiter	passus	uter
fossa	persuadeo	vester
frumentum	pes	viginti
gladius	plurimus	vulnero
incolo	plus	

Results with the 239 words in terms of the averages and median numbers correct from 19 schools in three states appear in Table VI. The table gives both the averages and medians for the convenience of teachers or principals who may wish to use one or the other measure of central tendencies. The distribution is skewed and the medians and averages, it will be noted, not only do not coincide except in a few cases, but in some cases the difference is considerable. The average number correct for second year pupils, *e. g.*, is 187 while the median is 195. Exceptionally poor or exceptionally good pupils in a class will produce discrepancies in the two measures.

As in the first year test the striking thing is the wide variation in schools, *e. g.*, in the first year the range from a median of 56 in one school to 209 in another. It is noteworthy that even fourth-year pupils fall short, by a considerable amount, of a perfect score with this easy vocabulary.

ARRANGEMENT OF WORDS IN ORDER OF DIFFICULTY AND THE DETERMINATION OF SCALE VALUES

The averages and medians in Table VI were obtained simply by scoring the number of words correct, regardless of the variation in the difficulty of the words. The main purpose of this study has been to determine first the weights or values to be assigned to each word for each year and finally a general or average scale value for all four years. The essential information

TABLE VI.

Results from Nineteen Schools

School	Averages				School	Medians				School	No. of Pupils			
	I	II	III	IV		I	II	III	IV		I	II	III	IV
A	178	212	225	227	A	175	209	226	227	A	15	14	9	8
B	172	202	215	223	B	172	200	215	229	B	58	37	10	10
C	140	185	215	216	C	144	195	217	217	C	35	20	13	7
D	146	165	207	198	D	149	169	211	205	D	32	31	18	8
E	123	154	160	179	E	123	159	160	184	E	26	37	2	7
F	108	187	192	...	F	110	183	193	...	F	9	8	6	..
G	170	203	...	...	G	170	210	...	...	G	48	24	..	..
H	78	173	190	202	H	56	162	191	208	H	5	5	6	3
I	170	201	222	225	I	173	202	222	223	I	9	3	2	3
J	149	196	222	221	J	152	209	222	218	J	23	9	2	5
K	133	199	220	223	K	136	204	221	225	K	23	19	5	8
L	117	168	205	206	L	115	168	203	208	L	9	12	5	4
M	145	175	206	223	M	149	182	200	224	M	12	10	14	8
N	172	179	205	209	N	174	174	207	216	N	25	17	12	7
O	201	215	220	224	O	209	219	222	225	O	19	18	8	9
P	144	210	216	217	P	150	209	215	217	P	9	4	3	2
Q	...	199	...	...	Q	...	199	...	...	Q	..	9	..	..
R	...	191	...	...	R	...	198	...	...	R	..	6	..	..
S	...	...	...	199	S	...	...	...	199	S	..	..	..	2
Av.	155	187	209	214	Med.	157	195	213	218	Total	357	283	115	92

and the results obtained are found in Table VII which gives the percent. of times each word was correct in each year, the corresponding P. E. values subtracted from the assumed zero point (—3.8 P. E.) and the final scale value. The 39 words that are starred include those which are troublesome to score such as *eo*, *multus*, *ne*, *quod*, those where an English equivalent which must be accepted as correct, is obvious, such as *committo*, *contendo*, *causa*, *consul*, *in*, and those that are so easy as not to be missed at all by third and fourth year pupils, such as *bonus*, *magnus*, *pater* and *sed*. In scoring the words the low percentages correct for *constituo*, *confero*, *contineo*, *infero*, *multus* and *trado* are due to the fact that *I constitute*, *I confer*, *I continue*, *I infer*, *many*, and *I trade* were scored as incorrect. These words are among those starred for omission. These are the only ones the scoring of which calls for especial comment here.

TABLE VII.

	Percents Correct				Year Scale Values				Genl. Scale Values
	I	II	III	IV	I	II	III	IV	
ab.....	92.7	97.5	97.3	98.9	1.6	.9	.9	.4	1.0
acer.....	73.3	68.8	86.0	93.5	2.9	3.1	2.2	1.6	2.4
accipio.....	66.6	79.1	88.6	94.6	3.2	2.6	2.0	1.4	2.3
acies.....	48.1	80.1	85.2	88.0	3.9	2.6	2.3	2.0	2.7
ad.....	91.8	96.4	95.6	97.8	1.7	1.1	1.3	.8	1.2
adventus.....	47.0	81.9	90.4	95.7	3.9	2.4	1.9	1.3	2.4
ager.....	83.5	82.2	80.8	72.8	2.4	2.4	2.5	2.9	2.5
aliquis.....	40.9	47.3	73.9	75.0	4.1	3.9	2.8	2.8	3.4
alius.....	52.9	63.9	71.3	72.8	3.7	3.3	3.0	2.9	3.2
alter.....	38.4	55.1	69.5	75.0	4.2	3.6	3.0	2.8	3.4
altus.....	72.2	71.7	86.0	94.6	2.9	2.9	2.2	1.4	2.4
amicus.....	91.8	96.0	96.5	97.8	1.7	1.2	1.1	.8	1.2
*amitto.....	36.1	65.7	79.9	85.7	4.3	3.2	2.6	2.2	3.1
animus.....	48.1	79.1	99.1	96.7	3.9	2.6	.3	1.1	2.0
annus.....	90.2	95.0	100.	98.9	1.9	1.4	0	.4	.9
ante.....	84.0	95.0	99.1	98.9	2.3	1.4	.3	.4	1.1
appello.....	36.1	77.7	89.5	93.5	4.3	2.7	1.9	1.6	2.6
apud.....	60.5	87.8	88.6	96.7	3.4	2.1	2.0	1.1	2.1
*arma.....	87.4	92.2	91.2	96.7	2.1	1.7	1.8	1.1	1.7
atque.....	64.7	90.1	97.3	98.9	3.2	1.9	.9	.4	1.6
audio.....	95.8	97.2	97.3	98.9	1.2	1.0	.9	.4	.9
auxilium.....	91.3	97.2	100.	98.9	1.8	1.0	0	.4	.8
bellum.....	97.8	98.9	100.	98.9	.8	.4	0	.4	.4
*bonus.....	99.1	98.6	99.1	100.	.3	.5	.3	0	.3
capio.....	87.6	92.9	97.3	97.8	2.1	1.6	.9	.8	1.4
caput.....	74.2	78.7	91.2	95.7	2.8	2.6	1.8	1.3	2.1
castra.....	94.4	98.6	100.	100.	1.3	.5	0	0	.5
*causa.....	87.4	96.1	99.1	98.9	2.1	1.2	.3	.4	1.0
celer.....	68.3	69.3	79.9	84.8	3.1	3.1	2.6	2.3	2.7
centum.....	69.2	88.3	94.7	97.8	3.1	2.0	1.4	.8	1.8
certus.....	32.8	66.9	84.3	89.1	4.5	3.2	2.3	2.0	3.0
cognosco.....	60.8	93.3	98.2	97.8	3.4	1.6	.7	.8	1.6
*committo.....	56.0	66.4	71.3	75.0	3.6	3.2	3.0	2.8	3.1
*confero.....	29.4	60.1	66.9	64.1	4.6	3.4	3.2	3.3	3.6
conficio.....	14.3	38.5	57.4	68.4	5.4	4.2	3.5	3.1	4.1
conicio.....	11.5	60.8	68.7	79.3	5.6	3.4	3.1	2.6	3.7
consilium.....	58.2	85.5	86.0	89.1	3.1	2.2	2.2	2.0	2.4
*constituo.....	25.2	74.2	82.6	87.0	4.8	2.8	2.4	2.1	3.0
*consul.....	90.2	89.5	94.7	93.5	1.9	1.9	1.4	1.6	1.7
*contendo.....	72.0	87.3	95.6	95.7	2.9	2.1	1.3	1.3	1.9
*contineo.....	28.8	51.0	52.1	52.2	4.6	3.8	3.7	3.7	4.0
convenio.....	45.1	72.1	73.0	87.0	4.0	2.9	2.9	2.1	3.0
*copia.....	65.8	64.3	71.3	67.4	3.2	3.3	3.0	3.1	3.1
corpus.....	76.4	86.6	97.3	98.9	2.7	2.2	.9	.4	1.6
cum.....	98.3	99.3	99.1	98.9	.7	.2	.3	.4	.4
cur.....	62.2	70.3	92.1	94.6	3.3	3.0	1.7	1.4	2.4
de.....	85.1	85.5	99.1	98.9	2.3	2.2	.3	.4	1.3
debeo.....	42.3	42.1	75.6	79.3	4.1	4.1	2.8	2.6	3.4

TABLE VII.—Continued

	Percents Correct				Year Scale Values				Genl. Scale Values
	I	II	III	IV	I	II	III	IV	
decem.....	94.4	97.5	97.3	97.8	1.4	.9	.9	.8	1.0
*defendo.....	96.3	98.5	100.	98.9	1.2	.5	.0	.4	.5
deligo.....	17.9	52.6	69.5	79.3	5.2	3.7	3.0	2.6	3.6
deus.....	79.5	86.2	94.7	100.	2.6	2.2	1.4	.0	1.5
dico.....	82.3	96.8	99.1	98.9	2.4	1.1	.3	.4	1.0
dies.....	87.6	92.9	96.5	94.6	2.1	1.6	1.1	1.4	1.5
difficilis.....	87.6	85.5	87.8	95.7	2.1	2.2	2.1	1.3	1.9
discedo.....	27.4	51.9	54.7	71.7	4.7	3.7	3.6	2.9	3.7
diu.....	52.1	58.3	69.5	84.8	3.7	3.5	3.0	2.3	3.1
do.....	87.6	91.2	93.0	93.5	2.1	1.8	1.6	1.6	1.8
*domus.....	92.4	97.2	100.	100.	1.7	1.0	.0	.0	.7
duco.....	91.8	97.9	100.	98.9	1.7	.8	.0	.4	.7
dum.....	19.3	69.3	81.7	93.5	5.1	3.1	2.5	1.6	3.0
duo.....	90.4	95.7	99.1	100.	1.9	1.3	.3	.0	.9
dux.....	84.6	93.3	99.1	97.8	2.3	1.6	.3	.8	1.2
educo.....	51.8	86.1	90.4	95.7	3.7	2.2	1.9	1.3	2.3
ego.....	82.0	73.9	94.7	95.7	2.4	2.9	1.4	1.3	2.0
*eo.....	51.5	67.1	73.0	78.3	3.7	3.1	2.9	2.6	3.1
eques.....	37.5	37.5	53.0	47.8	4.3	4.3	3.7	3.9	4.0
*et.....	98.8	98.9	100.	100.	.5	.4	.0	.0	.2
etiam.....	43.1	78.4	84.3	85.7	4.6	2.6	2.3	2.2	2.8
ex.....	93.0	98.8	100.	100.	1.6	.4	.0	.0	.5
exercitus.....	82.6	96.1	97.3	92.4	2.4	1.2	.9	1.7	1.6
*extremus.....	70.8	86.5	88.6	96.7	3.0	2.2	2.0	1.1	2.1
facilis.....	80.6	78.0	81.7	92.4	2.5	2.7	2.5	1.7	2.3
facio.....	88.8	97.8	97.3	100.	2.0	.8	.9	.0	.9
fero.....	43.1	73.8	91.2	92.4	4.1	2.9	1.8	1.7	2.6
fides.....	48.2	72.4	85.2	89.1	3.9	2.9	2.3	2.0	2.7
filius.....	79.2	79.1	93.0	95.7	2.6	2.6	1.6	1.3	2.0
finis.....	89.9	92.1	100.	98.9	1.9	1.7	.0	.4	1.0
*finitimus.....	34.4	46.6	53.9	51.0	4.4	3.9	3.7	3.8	3.9
fio.....	27.2	45.2	46.1	56.5	4.7	4.0	3.9	3.6	4.0
fortis.....	81.5	84.0	95.6	93.5	2.5	2.3	1.3	1.6	1.9
*fortuna.....	90.4	98.5	100.	96.7	1.9	.5	.0	1.1	.9
*frater.....	87.9	93.9	99.1	100.	2.1	1.5	.3	.0	1.0
fuga.....	56.8	77.3	86.9	88.0	3.5	2.7	2.1	2.1	2.6
gero.....	77.6	90.0	94.7	94.6	2.7	1.9	1.4	1.4	1.8
gratia.....	28.8	41.7	73.9	70.7	4.2	4.1	2.9	3.0	3.5
gravis.....	74.8	79.8	96.5	95.7	2.8	2.6	1.1	1.3	1.9
habeo.....	89.6	97.8	98.2	98.9	1.9	.8	.7	.4	1.0
hic.....	86.5	87.9	92.1	95.7	2.2	2.1	1.7	1.3	1.8
homo.....	82.0	88.6	95.6	96.7	2.4	2.0	1.3	1.1	1.7
hostis.....	96.3	98.5	100.	97.8	1.2	.5	.0	.8	.6
humilis.....	42.8	42.7	66.9	66.3	4.1	4.1	3.2	3.2	3.6
iam.....	50.4	67.1	91.2	93.5	3.8	3.1	1.8	1.6	2.6
ibi.....	51.2	68.5	73.0	75.0	3.8	3.1	2.9	2.8	3.1
idem.....	43.7	71.3	92.1	87.0	4.0	3.0	1.7	2.1	2.7
ignis.....	76.2	87.2	93.0	95.7	2.7	2.1	1.6	1.3	1.9

TABLE VII.—Continued

	Percents Correct				Year Scale Values				Genl. Scale Values
	I	II	III	IV	I	II	III	IV	
ille.....	70.8	62.1	94.7	90.2	3.0	3.3	1.4	1.9	2.4
*imperium.....	46.5	80.8	93.0	92.5	3.9	2.5	1.6	1.6	2.4
impero.....	61.3	88.6	92.1	92.4	3.4	2.0	1.7	1.7	2.2
impetus.....	50.4	75.5	90.4	88.0	3.8	2.8	1.9	2.1	2.6
*in.....	94.6	95.3	99.1	100.	1.4	1.3	.3	0	.8
incendo.....	53.2	80.1	97.3	98.9	3.7	2.5	.9	.4	1.9
*infero.....	25.8	60.7	67.8	71.7	4.8	3.4	3.1	2.9	3.6
iniuria.....	60.5	84.7	85.2	91.3	3.4	2.3	2.3	1.8	2.4
*instruo.....	20.7	54.0	65.2	81.5	5.0	3.7	3.2	2.5	3.6
inter.....	70.0	94.3	96.5	97.8	3.0	1.5	1.1	.8	1.6
ipse.....	56.3	87.2	96.5	92.4	3.6	2.1	1.1	1.7	2.1
is.....	74.8	80.8	87.8	94.6	2.8	2.5	2.1	1.4	2.2
ita.....	54.6	79.5	92.1	90.2	3.6	2.6	1.7	1.9	2.4
iter.....	69.4	88.0	95.6	92.4	3.0	2.1	1.3	1.7	2.0
iubeo.....	67.2	90.8	95.6	97.8	3.1	1.8	1.3	.8	1.8
latus.....	70.0	73.5	91.2	93.5	3.0	2.9	1.8	1.6	2.3
locus.....	84.8	98.2	99.1	100.	2.3	.5	.3	0	.8
longus.....	88.5	91.5	96.5	98.9	2.0	1.8	1.1	.4	1.3
lux.....	52.1	65.3	96.5	98.9	3.7	2.9	1.1	.4	2.0
*magnus.....	99.4	98.2	100.	98.9	.1	.7	0	.4	.3
malo.....	14.3	17.6	42.6	41.3	5.4	5.2	4.1	4.1	4.7
malus.....	81.5	78.1	91.2	88.0	2.5	2.7	1.8	2.1	2.2
manus.....	74.5	90.4	98.2	100.	2.8	1.9	.7	0	1.3
*mater.....	97.5	97.9	99.1	100.	.9	.8	.3	0	.5
meus.....	79.2	75.9	90.4	93.5	2.6	2.8	1.9	1.6	2.2
mille.....	65.0	78.4	94.7	91.3	3.2	2.6	1.4	1.8	2.3
miles.....	68.9	62.8	76.5	78.3	3.1	3.3	2.7	2.6	2.9
mitto.....	94.9	96.4	99.1	96.7	1.4	1.1	.3	1.1	1.0
mors.....	71.4	76.6	88.6	91.3	3.0	2.7	2.0	1.8	2.4
mos.....	11.5	30.3	46.9	77.2	5.6	4.6	3.9	2.7	4.2
moveo.....	93.5	96.5	96.5	96.7	1.6	1.1	1.1	1.1	1.2
*multus.....	45.9	49.4	53.9	58.7	4.0	3.8	3.7	3.5	3.8
munio.....	71.1	80.9	86.9	81.5	3.0	2.5	2.1	2.5	2.5
murus.....	85.4	90.4	97.3	96.7	2.2	1.9	.9	1.1	1.5
nam.....	35.0	75.9	87.8	89.1	4.4	2.8	2.1	2.0	2.8
navis.....	85.7	95.0	91.2	92.4	2.2	1.4	1.8	1.7	1.8
*ne.....	60.8	81.5	82.6	87.0	3.4	2.5	2.4	2.1	2.6
nemo.....	40.9	62.1	85.2	87.0	4.1	3.3	2.3	2.1	3.0
neque.....	48.7	83.7	95.6	92.4	3.8	2.3	1.3	1.7	2.3
nihil.....	72.0	82.6	96.5	97.8	2.9	2.4	1.1	.8	1.8
nisi.....	16.5	45.2	85.2	91.3	5.2	4.0	2.3	1.8	3.3
nomen.....	59.9	84.7	95.6	97.8	3.4	2.3	1.3	.8	1.9
non.....	97.4	97.1	100.	92.4	2.1	1.0	0	1.7	1.2
noster.....	68.0	86.0	94.7	91.3	3.1	2.2	1.4	1.8	2.1
novem.....	54.9	43.4	62.6	79.3	3.6	4.0	3.3	2.6	3.4
novus.....	46.5	66.0	89.5	93.5	3.9	3.2	1.9	1.6	2.7
*nox.....	62.4	86.5	100.	100.	3.3	2.2	0	0	1.4
nullus.....	50.1	79.4	92.1	92.4	3.8	2.6	1.7	1.7	2.4

TABLE VII.—Continued

	Percents Correct				Year Scale Values				Genl. Scale Values
	I	II	III	IV	I	II	III	IV	
nunc.....	42.6	48.7	93.0	97.8	4.1	3.8	1.6	.8	2.6
nuntius.....	65.5	77.3	90.4	83.7	3.2	2.7	1.9	2.3	2.5
ob.....	12.9	25.1	50.4	62.0	5.5	4.8	3.8	3.3	4.4
*occupo.....	86.0	95.0	93.0	96.7	2.1	1.4	1.6	1.1	1.6
omnis.....	89.3	97.1	100.	98.9	2.0	1.0	0	.4	.8
oppugno.....	79.5	94.6	93.9	94.6	2.6	1.4	1.5	1.4	1.7
opus.....	50.7	78.0	86.9	83.7	3.8	2.7	2.1	2.3	2.7
pars.....	77.6	91.0	92.1	93.5	2.7	1.8	1.7	1.6	1.9
parvus.....	92.1	92.8	99.1	97.8	1.7	1.6	.3	.8	1.1
*pater.....	96.6	96.7	100.	100.	1.0	1.1	0	0	.5
patior.....	12.0	24.7	61.7	63.0	5.5	4.8	3.4	3.3	4.3
pauci.....	66.4	86.8	96.5	97.8	3.2	2.1	1.1	.8	1.8
pax.....	68.3	77.7	92.1	94.6	3.1	2.7	1.7	1.4	2.2
per.....	73.9	87.5	96.5	98.9	2.9	2.1	1.1	.4	1.6
periculum.....	86.5	96.4	100.	98.9	2.2	1.1	0	.4	.9
pervenio.....	47.3	81.9	79.9	80.4	3.9	2.4	2.6	2.5	2.9
peto.....	57.1	83.0	93.9	92.4	3.5	2.4	1.5	1.7	2.3
pono.....	55.7	68.1	86.9	92.4	3.6	3.1	2.1	1.7	2.6
populus.....	94.9	97.8	99.1	98.9	1.4	.8	.3	.4	.7
possum.....	81.8	91.1	98.2	96.7	2.5	1.8	.7	1.1	1.5
*posterus.....	22.4	49.1	60.8	59.8	4.9	3.8	3.4	3.4	3.9
post.....	79.0	90.7	92.1	95.7	2.6	1.8	1.7	1.3	1.8
praesum.....	29.1	52.6	66.9	64.1	4.6	3.7	3.2	3.4	3.7
primus.....	93.0	97.8	99.1	100.	1.6	.8	.3	.0	.7
princeps.....	71.4	76.6	87.8	91.3	3.0	2.7	2.1	1.8	2.4
pro.....	52.6	70.6	85.2	91.3	3.7	2.8	2.3	1.8	2.7
proelium.....	90.2	98.1	98.2	98.9	1.9	.4	.7	.4	.9
profiscor.....	41.7	77.3	80.8	82.6	4.1	2.7	2.5	2.4	2.9
puer.....	98.6	96.4	96.5	98.9	.5	1.1	1.1	.4	.8
pugno.....	95.2	98.8	100.	97.8	1.3	.4	0	.8	.6
quam.....	56.0	59.3	71.3	71.7	3.6	3.2	3.0	3.0	3.2
quartus.....	55.7	74.5	74.7	91.3	3.6	2.8	2.8	1.8	2.8
quattuor.....	75.6	76.2	78.2	94.6	2.8	2.7	2.6	1.4	2.6
que.....	45.9	68.5	62.6	80.4	4.0	3.1	3.3	2.5	3.2
qui.....	68.6	89.7	97.3	97.8	3.1	1.9	.9	.8	1.7
quis.....	68.6	51.5	69.5	80.4	3.1	3.7	3.0	2.5	2.8
quisquam.....	11.8	25.4	47.8	46.7	5.6	4.8	3.9	3.9	4.5
quisque.....	15.4	28.2	32.2	40.2	5.3	4.7	4.5	4.2	4.7
*quod.....	62.7	89.0	88.6	94.6	3.3	1.9	2.0	1.4	2.2
recipio.....	55.2	81.5	94.7	93.5	3.6	2.5	1.4	1.6	2.3
regnum.....	70.3	83.3	89.4	95.7	3.0	2.4	1.9	1.3	2.1
relinquo.....	55.7	65.7	90.4	96.7	3.6	3.2	1.9	1.1	2.4
res.....	77.0	87.2	99.1	92.4	2.7	2.1	.3	1.7	1.7
rogo.....	25.5	59.3	86.9	93.5	4.8	3.5	2.1	1.6	3.0
saepe.....	86.5	81.5	100.	95.7	2.1	2.5	0	1.3	1.5
satis.....	29.1	72.0	92.1	93.5	4.6	2.9	1.7	1.6	2.7
scio.....	41.4	58.2	93.0	95.7	4.1	3.5	1.6	1.3	2.6
secundus.....	87.9	93.5	94.7	94.6	2.1	1.6	1.4	1.4	1.6

TABLE VII.—Continued

	Percents Correct				Year Scale Values				Genl. Scale Values
	I	II	III	IV	I	II	III	IV	
*sed.....	94.1	97.8	100.	100.	1.5	.8	0	0	.6
senatus.....	54.9	86.5	90.4	93.5	3.6	2.2	1.9	1.6	2.3
sequor.....	54.9	83.0	95.6	100.	3.6	2.4	1.3	0	1.8
servus.....	92.4	91.4	93.0	82.6	1.7	1.8	1.6	2.4	1.9
si.....	73.9	95.7	98.2	100.	2.9	1.3	.7	0	1.2
signum.....	91.8	98.8	98.2	96.7	1.7	.5	.7	1.1	1.0
similis.....	82.0	91.4	97.3	98.9	2.4	1.8	.9	.4	1.4
sine.....	54.6	80.5	97.3	96.7	3.6	2.5	.9	1.1	2.0
solus.....	66.6	65.0	87.8	93.5	3.1	3.2	2.1	1.6	2.5
spes.....	53.2	87.9	98.2	100.	3.7	2.1	.7	.0	1.6
*sui.....	35.6	54.0	71.3	64.1	4.3	3.7	3.0	3.3	3.6
sum.....	78.1	84.4	97.3	94.6	2.7	2.3	.9	1.4	1.8
supero.....	71.7	80.1	93.0	84.8	2.9	2.5	1.6	2.3	2.3
*superus.....	32.3	58.2	58.2	65.2	4.5	3.5	3.5	3.2	3.7
suus.....	51.2	60.0	78.2	81.5	3.8	3.4	2.6	2.5	3.1
tam.....	46.5	45.9	74.7	69.6	3.9	4.0	2.8	3.0	3.4
tamen.....	46.2	75.2	85.2	82.6	3.9	2.8	2.3	2.4	2.8
tantus.....	31.6	65.7	83.4	87.0	4.5	3.2	2.4	2.1	3.0
telum.....	85.7	95.3	97.3	98.9	2.2	1.3	.9	.4	1.2
tempus.....	69.7	86.5	97.3	97.8	3.0	2.2	.9	.8	1.7
teneo.....	63.3	92.5	98.2	98.9	3.3	1.7	.7	.4	1.5
tertius.....	58.0	88.2	97.3	98.9	3.5	2.0	.9	.4	1.7
timeo.....	75.0	91.8	98.2	100.	2.8	1.7	.7	.0	1.3
totus.....	60.9	82.4	71.9	78.4	3.4	2.4	2.9	2.6	2.8
*trado.....	25.2	39.2	44.3	41.3	4.8	4.2	4.0	4.1	4.3
tres.....	88.8	89.3	91.2	97.8	2.0	2.0	1.8	.8	1.7
tu.....	66.1	78.0	96.5	98.9	3.2	2.7	1.1	.4	1.8
tum.....	32.2	53.7	76.5	90.2	4.5	3.7	2.7	1.9	3.2
tuus.....	63.3	65.7	94.3	91.3	3.3	3.2	1.5	1.8	2.4
ubi.....	76.7	78.4	85.2	89.1	2.7	2.6	2.3	2.0	2.4
ullus.....	23.5	40.9	66.9	83.7	4.9	4.2	3.2	2.3	3.6
*ulterior.....	19.3	49.8	61.7	51.0	5.1	3.8	3.4	3.8	4.0
undique.....	22.7	64.6	65.2	69.6	4.9	3.2	3.2	3.0	3.6
*unus.....	97.7	97.8	100.	100.	.8	.8	0	0	.4
urbs.....	97.4	95.3	100.	98.9	.9	1.3	0	.4	.7
ut.....	79.8	93.5	95.6	95.7	2.6	1.6	1.3	1.3	1.7
vasto.....	70.0	88.1	83.4	82.6	3.0	2.0	2.4	2.4	2.5
venio.....	89.9	93.9	99.1	97.8	1.9	1.5	.3	.8	1.1
verecor.....	30.2	55.1	72.1	68.4	4.6	3.6	2.9	3.1	3.6
via.....	93.8	93.5	98.2	98.9	1.5	1.6	.7	.4	1.0
*video.....	95.2	97.8	100.	100.	1.3	.8	0	0	.5
vinco.....	67.2	74.8	95.6	92.4	3.1	3.0	1.3	1.7	2.3
vir.....	97.4	96.7	98.2	98.9	.9	1.1	.7	.4	.8
virtus.....	80.1	84.0	86.0	100.	2.5	2.3	2.2	0	1.8
vis.....	50.7	72.7	89.5	95.7	3.8	2.9	1.9	1.3	2.5
vita.....	66.6	73.1	93.0	97.8	3.2	2.9	1.6	.8	2.1
volo.....	65.8	89.3	96.5	95.7	3.2	2.0	1.1	1.3	1.9
					735.2	566.3	398.0	361.3	513.9

The method of determining the scale values for each year is that briefly described above for the first year test. The procedure may be illustrated as follows: *ab* was correctly translated by 331 out of 357 first year pupils, or, 92.7 percent. The P. E. equivalent on the base line of a normal surface of frequency is -2.155 P. E.⁴ This value subtracted from -3.8 P. E. gives 1.645 or 1.6 the scale value assigned to it for the first year. In the second year *ab* was given correctly by 276 out of 283 pupils. The P. E. equivalent is -2.905 P. E., which subtracted from -3.8 P. E., gives .895, or .9 the assigned value. This procedure was carried out for each of the words and for each year. The sum of the values for each year appears at the foot of the Table. If the entire list of words is used with first year pupils then a perfect score would be 735.2. Toward this score for a correct translation of *ab* the pupil would receive 1.6. If the list is given to second year pupils the perfect score would be 566.3 and toward this score for a correct translation of *ab* he would receive .9.

If the selected list of 200 words is used then the average scores and the sum of the scale values would be as follows:

	I	II	III	IV	...
Averages.....	130	156	177	181	
Sum of Scale Values.....	621.9	479.4	330.6	297.4	430.7

The determination of the general or average scale value is somewhat more troublesome. The method employed is that described in detail by Buckingham.⁵ It is necessary to discover the size of the intervals between the medians of the different years. This involves determining the amount and percent. of overlapping between the different years. Some first-year pupils reach or exceed the median ability of the second-year pupils, a smaller number that of the third year and a still smaller number that of the fourth year. The following Table VIII sets forth the facts.

The table reads as follows: Among first-year pupils there were 50 or 14.1 percent who reached or exceeded the median of the second-year pupils, the P. E. equivalent being $+1.595$ P. E. There were 18 first-year pupils, or 50 percent, who reached or

⁴See Table of P. E. Values corresponding to Given Percents of the Normal Surface of Frequency, Buckingham, op. cit., p. 116.

⁵Op. cit., pp. 31-40. Also BUCKINGHAM—*Notes on the Derivation of Scales in School Subjects*. Fifteen Yearbook of the Nat. Soc. for the Study of Education, Part I, 1916, pp. 33-40.

TABLE VIII.

Number and Percent of Pupils Reaching or Exceeding the Median in Every Other Year

	I	II	III	IV
I. No.....	50	18	11	
Percent.....	14.1	5.0	3.1	
P. E.....	+1.595	+2.439	+2.767	
II. No.....	234	64	49	
Percent.....	82.7	22.6	17.3	
P. E.....	-1.397	+1.115	+1.397	
III. No.....	114	95	44	
Percent.....	99.1	82.6	38.3	
P. E.....	-3.506	-1.391	+ .441	
IV. No.....	90	80	62	
Percent.....	97.8	86.9	67.4	
P. E.....	-2.986	-1.663	- .669	

exceeded the median ability of the third-year pupils, the P. E. equivalent being +2.439 P. E. From this table it is possible to determine various direct and derived values for the intervals between the first-year median taken as a point of reference and the other years. For example there are various values for the interval or median distance between the first year and the second year in terms of units of P. E. The distance between the first-year and the second year is directly represented by two values 1.595 and 1.397, two other derived values are obtained by subtracting from the distance between the first and third year medians the distance between the second and third year medians and this same distance expressed negatively, viz., 1.324 and 2.115, two other derived values by subtracting from the distance between the first and fourth year medians, the distance between the second and fourth year medians and also this distance expressed negatively, viz., 1.370 and 1.323. Other derived values are possible, but these six were regarded as sufficient for determining the distances between the medians. The average value for the interval between the first year and the second year is 1.521. This average gives the same value to all the measures of the intervals, direct and derived. The intervals obtained directly are more reliable than those obtained indirectly. These were given a weight of 6 and the other two involving a skipping of one or two medians were weighted 4 and 2, respectively. The weighted average then becomes 1.541. Carrying this method out for each year the intervals between the years are as follows:

$$\begin{array}{l} M_1-M_2 \\ 1.541 \text{ P. E.} \end{array}$$

$$\begin{array}{l} M_2-M_3 \\ 1.281 \text{ P. E.} \end{array}$$

$$\begin{array}{l} M_3-M_4 \\ .465 \text{ P. E.} \end{array}$$

When referred to the first year median the median distance between it and the third and fourth years are:

$$\begin{array}{ll} M_1-M_3 & M_1-M_4 \\ 2.821 \text{ P. E.} & 3.287 \text{ P. E.} \end{array}$$

The intervals between the various years being known, all that is necessary to do to determine the general scale value is to add to the P. E. value for the first year the intervals at which the medians of each year stand above the first year. The average of the values thus obtained gives the average position of the word. The method is illustrated for two words as follows:

	P. E.		P. E.
	I	II	III
<i>ab</i>	2.155	2.905	2.857
<i>acer</i>.....	.922	.727	1.602
			IV
			3.395
			2.245

When referred to the first year median as the point of reference, by adding to the second, third and fourth year P. E.s the interval between the medians 1.541, 2.822 and 3.287, respectively, and averaging the positions we get the following:

	P. E.	P. E.	P. E.	P. E.	Average
	I	II	III	IV	Position
<i>ab</i>	-2.155	-1.364	-.035	-.108	-.915
<i>acer</i>	-.922	+.814	+1.220	+1.042	+.538

Thus far the procedure in scaling the words is identical with that of Buckingham. The average position when referred to the first year median as the point of reference, however, because of the fact that there were many very easy words in the list would give a scale with — and + values. To rid the scale of the minus values, I planned to use as point of reference, not the first year median, but the position of the easiest word in the list. This is *et* with an average position —1.673. Inability to give the meaning of *et* is pretty close to the zero point in ability in Latin. The easiest word for the first year pupils, however, is *magnus* and for second year pupils *cum*. No word was translated correctly by all first and second year pupils. There were some words that were correctly translated by all third and fourth year pupils and the scale values are undetermined. A point of reference below the position of *et* was arrived at as follows: The arbitrarily assumed zero point for each year indicated above is —3.8. P. E. On the scale this would be the position occupied by a word which would be translated correctly by 995 out of 1000

pupils. When this position for each year is referred to the first year median by adding as before 1.541, 2.822 and 3.287 respectively, we get:

—3.8	P. E. for the first year
—2.259	P. E. " " second year
— .978	P. E. " " third year
— .513	P. E. " " fourth year

Av. 1.887

The average position thus obtained is -1.887 , which was taken as the point of reference. The position of the easiest word *et* -1.673 then by subtraction from -1.887 is $+.214$ or $.2$ the assigned value. *Ab* with an average position $-.915$ when referred to this point of reference has an assigned value of $+.972$ or 1.0 . *Acer* with an average position $+.538$ when so referred gets a value of $+2.425$ or 2.4 . This procedure which has the effect of averaging the positions of the words for the four years was carried out for all the words and is the basis for the general scale value indicated in Table VII.

The general scale value is an attempt to determine the variation in the difficulty of each word or the weight to be assigned to it, regardless of the year or grade. Practically, the year scale values will perhaps be more useful than the general scale value, for after all, our measurements of ability in Latin vocabulary will be of pupils who have had one, or two, or three or four years of Latin and the uses of the measurements will be to compare pupils, classes and schools under these conditions.

There were certain words that were not missed in either the third or the fourth years and a few that were not missed by any third and fourth year pupils. The P. E. equivalents in these years are of course indeterminate. In order to give these words a position in the general scale, it was necessary to assign them some value. The assumption was made that if more pupils had been tested, they would have been missed by five out of a thousand pupils, and the P. E. equivalent -3.8 was arbitrarily assigned to each of them. No attempt was made to vary this value on a basis of the behavior of the words in the first two years.

The list of words may be used in various ways: the entire list may be given and valuable comparison made with performances in typical high schools without regard to the scale values; better would be the use of the 200 words not starred without the scale

values; still better would be to give the entire list or the selected list and assign the weights given in Table VII, using either the general scale values, or the year scale values.

There are, however, two uses which may be made of the data which will be practically valuable: (1) A selection may be made of a smaller list of words, having the same, or approximately the same, scale values, which may then be disregarded. A selected list of twenty-five such words is given below. The words selected are those which decrease in difficulty progressively by fairly uniform steps, from the first year on. They are not too difficult for first year pupils, nor too easy for fourth year pupils. Such a list ought to be of use for many testing purposes.

Selected List of 25 Words and Scale Values

	I	II	III	IV	Average
accipio.....	3.2	2.6	2.0	1.4	2.3
adventus.....	3.9	2.4	1.9	1.3	2.4
appello.....	4.3	2.7	1.9	1.6	2.6
apud.....	3.4	2.1	2.0	1.1	2.1
caput.....	2.8	2.6	1.8	1.3	2.1
certus.....	4.5	3.2	2.3	2.0	3.0
cur.....	3.3	3.0	1.7	1.4	2.4
dum.....	5.1	3.1	2.5	1.6	3.0
educo.....	3.7	2.2	1.9	1.3	2.3
ignis.....	2.7	2.1	1.6	1.3	1.9
is.....	2.8	2.5	2.1	1.4	2.2
latus.....	3.0	2.9	1.8	1.6	2.3
mors.....	3.0	2.7	2.0	1.8	2.4
novus.....	3.9	3.2	1.9	1.6	2.7
pax.....	3.1	2.7	1.7	1.4	2.2
post.....	2.6	1.8	1.7	1.3	1.8
princeps.....	3.0	2.7	2.1	1.8	2.4
pro.....	3.7	2.8	2.3	1.8	2.7
regnum.....	3.0	2.4	1.9	1.3	2.1
relinquo.....	3.6	3.2	1.9	1.1	2.4
rogo.....	4.8	3.5	2.1	1.6	3.0
suus.....	3.8	3.4	2.6	2.5	3.1
tantus.....	4.5	3.2	2.4	2.1	3.0
tum.....	4.5	3.7	2.7	1.9	3.2
vis.....	3.8	2.9	1.9	1.3	2.5

With this list standard scores in terms of numbers and percents correct would be as follows:

	I	II	III	IV
Number correct.....	13.7	18.6	22.0	22.6
Percents correct.....	54.8	74.3	88.0	90.4

(2) The list of 200 words may be subdivided into alternative lists of equal difficulty. Such an arrangement appears in four lists A, B, C, and D with the words arranged in order of difficulty and the corresponding scale values.

Latin Vocabulary Test

A		B		C		D	
bellum	.4	cum	.4	castra	.5	ex	.5
populus	.7	duco	.7	pugno	.6	hostis	.6
primus	.7	urbs	.7	auxilium	.8	vir	.8
facio	.9	locus	.8	omnis	.8	puer	.8
duo	.9	audio	.9	annus	.9	proelium	.9
dico	1.0	decem	1.0	ab	1.0	periculum	1.0
finis	1.0	habeo	1.0	via	1.0	mitto	1.0
ante	1.1	parvus	1.1	venio	1.1	signum	1.0
moveo	1.2	dux	1.2	amicus	1.2	ad	1.2
non	1.2	si	1.2	telum	1.2	de	1.3
timeo	1.3	manus	1.3	manus	1.3	longus	1.3
dies	1.5	deus	1.5	similis	1.4	capio	1.4
murus	1.5	possum	1.5	saepe	1.5	teneo	1.5
exercitus	1.6	corpus	1.6	cognosco	1.6	atque	1.6
spes	1.6	secundus	1.6	per	1.6	inter	1.6
tertius	1.7	tempus	1.7	oppugno	1.7	homo	1.7
res	1.7	qui	1.7	ut	1.7	tres	1.7
hic	1.8	gero	1.8	do	1.8	centum	1.8
post	1.8	pauci	1.8	navis	1.8	iubeo	1.8
virtus	1.8	tu	1.8	sum	1.8	sequor	1.8
nihil	1.8	difficilis	1.9	fortis	1.9	gravis	1.9
servus	1.9	pars	1.9	nomen	1.9	ignis	1.9
ego	2.0	animus	2.0	volo	1.9	incendo	1.9
filius	2.0	iter	2.0	lux	2.0	sine	2.0
vita	2.1	apud	2.1	caput	2.1	ipse	2.1
malus	2.2	meus	2.2	noster	2.1	regnum	2.1
is	2.2	impero	2.2	pax	2.2	accipio	2.3
mille	2.3	latus	2.3	facilis	2.3	educo	2.3
neque	2.3	peto	2.3	senatus	2.3	supero	2.3
adventus	2.4	acer	2.4	recipio	2.3	vinco	2.3
altus	2.4	consilium	2.4	iniuria	2.4	ille	2.4
cur	2.4	ita	2.4	mors	2.4	nullus	2.4
princeps	2.4	relinquo	2.4	tuus	2.4	ubi	2.4
ager	2.5	munio	2.5	nuntius	2.5	solus	2.5
appello	2.6	fero	2.6	vis	2.5	vasto	2.5
iam	2.6	nunc	2.6	pono	2.6	quattuor	2.6
celer	2.7	acies	2.7	scio	2.6	fuga	2.6
fides	2.7	idem	2.7	novus	2.7	impetus	2.6
opus	2.7	pro	2.8	satis	2.8	etiam	2.8
nam	2.8	quis	2.8	tamen	2.8	totus	2.8
miles	2.9	pervenio	2.9	profiscor	3.0	convenio	3.0
rogo	3.0	meus	3.0	certus	3.0	dum	3.0
ibi	3.1	diu	3.1	suus	3.1	alius	3.2
tum	3.3	nisi	3.3	que	3.2	quam	3.2
aliquis	3.4	debeo	3.4	alter	3.4	novem	3.4
deligo	3.6	humilis	3.6	gratia	3.5	tam	3.4
ullus	3.6	undique	3.6	veroer	3.6	conicio	3.7
praesum	3.7	discedo	3.7	fio	4.0	eques	4.0
ulterior	4.0	conficio	4.1	mos	4.2	patior	4.3
quisque	4.7	malo	4.7	quisquam	4.5	ob	4.4
107.7		107.9		107.5		107.6	

The second point of attack in developing standard tests for Latin is to secure a measure of ability to translate not isolated words, but words as they occur in sentences. A sentence test to be of value should not contain words with which the pupil has not come in contact. One of the main purposes of the study of vocabularies was to secure materials for the construction of sentences which could fairly be used to test any high school pupil who had studied Latin for a year or more. Results with this test will be reported in the December issue of this JOURNAL.

A GRADUATED SCALE FOR DETERMINING MENTAL AGE

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In the face of the contemporary activity in the field of mental testing a considerable amount of courage is required to place before the public a group of tests which one may label a complete and comprehensive scale. Yet the results achieved by the use of the scale here presented seem to warrant its addition to the literature of the subject.

During the time in which the author was serving his novitiate in this field he early discovered the lack of system and coherence of the commonly used mental tests. The present study is the result of an attempt to work out a scale which would fill the requirements of a "first aid" test while investigating more or less thoroughly the mental type of the subject.

The characteristic features of the scale are: (1) The same tests are used for all ages and the mental age determined by the manner of the individual reaction, measured in terms of the relative number of points for each age. (Norms have been established for the ages six to fourteen, inclusive.) This method dispenses with a great amount of unnecessary labor both on the part of the experimenter and the child. (2) The tests chosen are of such a nature as to appeal to the interest of the child, whatever the age. Moreover, as a proof that they are genetic tests of intelligence, the ability to react to each test increases uniformly as we go up the age scale, with a wide range between upper and lower limits. (3) The tests measure native ability regardless of training. (4) The tests are comprehensive. (5) They are compact and systematic. (6) They may be quickly and easily applied, averaging about thirty minutes per subject. (7) The results are readily evaluated. (8) The results are significant both from the standpoint of the clinical psychologist and the teacher. It is believed that the scale is a simple and coherent system which may be used efficiently, both to determine mental age and mental type. In the hands of the novice it will indicate not only the group to which the child belongs, but also his predominating characteristics. The expert will find it valuable as an index to further tests which may be deemed necessary

for a more complete analysis of the subject's mentality. In either case, with careful manipulation, the mental age will be closely determined.

In establishing the norms presented in this work the tests were given personally by the author to about 550 children of the public schools of Lincoln, Nebraska. Deducting a number of cases tested before the scale was complete and others which were tested for clinical purposes, the total embodied in the evaluation of the norms is 405, an average of 45 for each age studied. These cases were selected from eight different schools, collectively representative of all classes of population usually found in a cosmopolitan community. The children were chosen by the principal in conjunction with the teacher, after the problem had been carefully explained by the experimenter. Teachers and principals, as well as children, were intensely interested in the work and put forth every effort to contribute toward its success. It was required of each child that he be "just average or normal," neither accelerated nor retarded; that is, that the pedagogical age should correspond with the chronological age. A great deal of confidence is placed in the type of children selected because of the fact that each principal had known practically every child from the time of entrance, in most cases being familiar with the child's family history. Furthermore, the work was undertaken at an opportune time, because of the fact that the Lincoln schools were systematically working out the problem of classification which had been inspired by the superintendent and fostered by the Principals' Club.

The children of each group were within the limits of five months over and four months under the year, with an average age very close to the exact year. (For example, the 7-year group averaged 7 years, 20 days, with a mean variation of 2 months, 3 days. The 9-year group averaged 9 years, 2 days, with a mean variation of 2 months, 11 days.)

The method employed in conducting the tests was similar to that used in the Binet tests and their modifications. A room was provided in each building which would be as quiet and free of disturbance as possible. A small table was placed opposite the window with the experimenter seated facing the light and the child on his right. From the moment the child entered the room he was treated with cordial respect and made to feel perfectly at ease, with the understanding that he was contributing toward the solution of a given problem rather than merely being

tested. In no case was the test begun until the child felt at home and was in an attitude which would produce uniform results. Each child was cautioned not to tell anything about the tests and in no case was there evidence of collusion. The tests were all given during the regular school hours.

The scale is composed of nine separate tests, divided into three general groups, as follows:

- A. Perception, Tests I and IX.
- B. Memory span.
 - a. Auditory, Tests II and III.
 - b. Visual, Test IV.
 - c. Logical, Test V.
- C. Judgment.
 - a. Visual proportion, Test VI.
 - b. Constructive problems, Test VII.
 - c. Definitions, Test VIII.

TEST BLANK

Name School Date

Grade Born

Mental Age Age

I. Card of objects (5 seconds) Bu. Co. Cr. Gla. Ky. Kni. Mbl. Na. Ni. Pn. Pcl.
Pi. Sci. Ser. St.

II. Repeating digits

III. Repeating syllables

IV. Learning figures, 1 2 3 Total

V. Association words (One Minute).

VI. Height of man standing by 50-foot tree. (Over) feet.

VII. Problems (1) Square (2) Rhombus (3) Rectangle
(4) Paper cut (5) Clock, 9:00 2:00 (6) Reconstruct
triangles (7) Paper cut.....

VIII. Definitions.

- (1) Fork.
- (2) Horse.
- (3) Automobile.
- (4) Poet.
- (5) Tree.
- (6) Kindness.
- (7) Sweetness.
- (8) Charity.
- (9) Justice.
- (10) Worm and snake.

IX. Sorting cards. min. sec. piles.....
Equivalent value min. sec.

TEST I.

Fifteen familiar objects were fastened upon a white cardboard 37 cm. square, and covered with another cardboard of the same dimensions. (See Fig. 1.)¹ When the attention of the subject

¹ Since the laws of the United States prohibit the photographic reproduction of stamps or coins, this figure cannot be presented. The objects, arranged in miscellaneous order, were button, comb, crayon, glasses (spectacles), key, knife, marble, nail, nickel (coin), pen, pencil, pipe, scissors, screw, stamp.—EDITOR.

has become focussed on the experiment, the objects are exposed for five seconds. The number of objects remembered, with mean variation, are given in the following table:

Age	6	7	8	9	10	11	12	13	14
Av.....	3.3	4.2	4.3	4.9	5.0	5.7	5.7	6.1	6.4
M. V.....	.61	.70	.84	.85	.98	1.0	.96	.92	1.2

TEST II.

The second is the Binet test for auditory memory span by use of digits. The child is directed to "Say these numbers after me." The subject is required to repeat correctly a group of digits in two out of three trials before passing to the next higher group. For example, in the 4-group, he may repeat 4-2-9-7 correctly, fail in repeating 5-3-1-8, and then repeat 6-1-9-4 correctly, when he will proceed to the next higher group.

29	847	4297	52814	384296	1695847	41629385
81	315	5318	47395	279314	2964375	25718394
73	926	6194	58319	618492	9285164	58261947

The test is scored on the basis of highest group passed. Below is the average number of digits for each age with mean variations: (For graphic representation see Fig. 2.)

Age	6	7	8	9	10	11	12	13	14
Av.....	4.4	4.9	5.5	5.7	5.6	5.8	6.0	6.1	6.4
M. V.....	.64	.56	.80	.70	.62	.57	.43	.44	.70

TEST III

The third is supplementary to the second test, being repetition of syllables. I have made use of Goddard's sentences with one or two slight changes. Beginning with sentences of a few syllables, the entire list is given until the child reaches his maximum, and credit is given for the number of syllables in the last sentence correctly repeated. In no case is the child informed of his errors; when the maximum has been reached, we pass immediately to the next test as if there were no more sentences to be given. In this, as in all the other tests, the child will watch for confirmation of his answers. The norms are given below (see also Fig. 3):

Age	6	7	8	9	10	11	12	13	14
Av.....	15.7	16.0	17.1	18.1	18.0	19.7	20.3	22.4	24.0
M. V.....	1.1	1.1	1.5	1.6	1.7	2.0	2.2	2.6	3.0

TEST IV.

The fourth test is for visual-motor memory. The material used is adapted from the odd-shaped figures in Seashore's *Manual* (See Fig. 4.) The method of procedure is as follows: The child

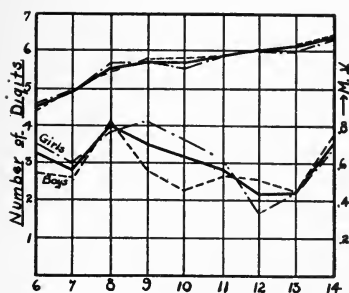


FIGURE 2

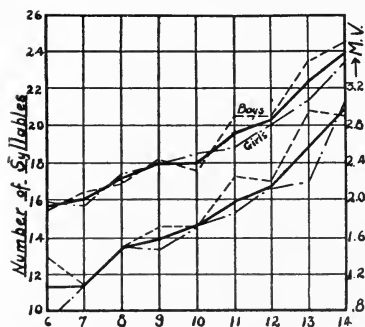


FIGURE 3



FIGURE 4

is given a piece of blank paper and shown the figures for about one second while the operator makes the following explanation: "Now I'm going to let you look at these things for just a few seconds, and then when I take them away, you will draw as many as you can remember." The figures are exposed for ten seconds. Three trials are given, the subject studies the figures before each trial, but is never permitted to look at his previous drawings. No hint is given of the number correctly drawn. Credit is given for the total number of correct figures for all three trials, allowing one-half point for reversed drawings. (See also Fig. 5.)

Age	6	7	8	9	10	11	12	13	14
Av.....	1.8	2.6	3.3	4.0	4.4	5.3	5.6	6.8	7.5
M. V.....	1.1	1.3	1.4	1.5	1.7	1.8	1.8	1.8	1.9

TEST V.

This test is adapted from the third in Binet's twelve year group, in which the child is required to name as many words as he can in three minutes. My instructions to the child are: "Shut your eyes. Now name over all the things you can think of; just anything—any object." If the subject does not respond at once the experimenter may suggest *book*, which usually starts the reaction. Credit is given for common nouns only. The reaction continues for one minute.

It is believed that this method is superior to that used by Binet for three reasons: (1) By having the eyes closed the material is largely introspective. (2) By allowing one minute instead of three time is saved and the child is not fatigued. The number of words in the first twenty seconds is usually greater than that of the last forty, and no advantage is gained by prolonging the time. (3). The instructions are given in a manner which causes the child to name nouns—things—rather than words. It becomes, then, a test of rapidity of association. (See Fig. 6.)

Age	6	7	8	9	10	11	12	13	14
Av.....	12.5	14.2	17.8	22.2	22.3	27.4	32.2	30.0	32.1
M. V.....	4.7	4.6	4.7	5.4	6.2	5.8	6.5	7.7	5.9

TEST VI.

The sixth test is a problem involving judgment of visual proportion. The child is told to "draw a picture of a tree fifty feet high with a man standing by it." For the ages six and seven this was varied, for obvious reasons to, "Draw a great big, high

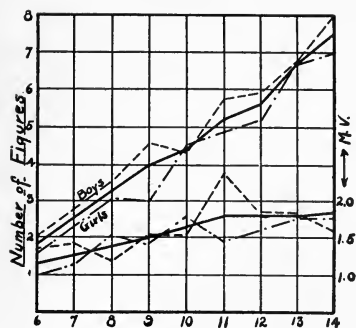


FIGURE 5

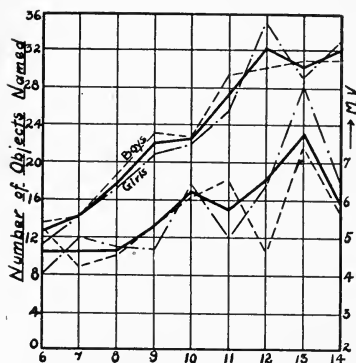


FIGURE 6

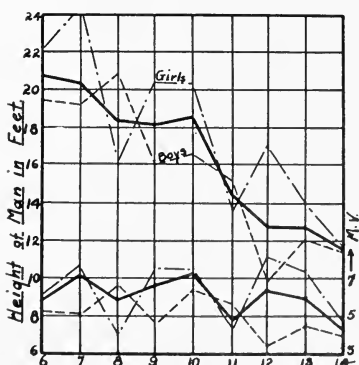
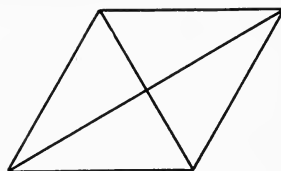
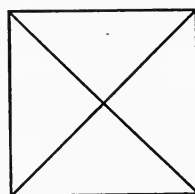


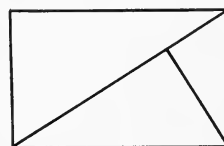
FIGURE 7



PROBLEM I



PROBLEM II



PROBLEM III

FIGURE 8

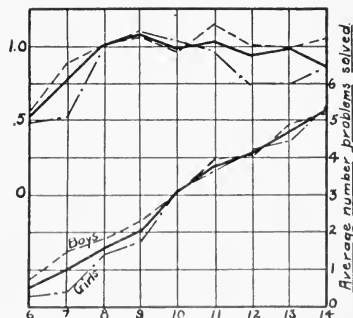


FIGURE 9

tree, fifty feet high, with a man standing by it." Credit was allowed for the relative height of the man, which correlates with intelligence to a remarkable degree. In clinical cases I have had a precocious girl of ten draw the man just six feet high while a badly retarded girl of fifteen drew the man twenty-two feet high. (See Fig. 7.)

Age	6	7	8	9	10	11	12	13	14
Height.....	20.8	20.4	18.4	18.2	18.6	14.5	12.9	12.9	11.7
M. V.....	5.7	7.3	6.0	6.8	7.3	4.7	6.6	5.9	4.4

TEST VII.

This is a group of seven problems designed to test the judgment, ingenuity, and concentration of the child. Problems 1, 2, and 3 are cardboard puzzles—fitting triangles together to produce a form which is placed before the subject. (See Fig. 8.) Problem 4 is the paper-cutting test used by Binet in the 1908 series. After folding a square paper on its diameters the inner corner is cut off. The child is required to draw a picture of the paper "as it would look unfolded." Problem 5 is interchanging the hands of the clock at 9:00 and 2:00. Problem 6 is the reversed triangle used by Binet in the adult series. The subject is asked to draw the resulting figure if edge AB of the lower triangle were placed against edge CD of the upper triangle with point B at D. Problem 7 is the Binet paper cutting test for adults, 1905 series, as indicated in the drawing.

These seven problems are grouped together in the final scale. The table gives the total number of correct solutions out of the seven. (See Fig. 9.)

Age	6	7	8	9	10	11	12	13	14
Av.....	.5	1.0	1.6	2.0	3.1	3.8	4.1	4.7	5.3
M. V.....	.6	.8	1.1	1.2	1.0	1.1	.9	1.0	.9

It may be mentioned that experience soon teaches an experimenter that it is useless to give all tests in this group to every child. Only the first four are given to the six and seven year groups. Problem 6 is seldom given to a child who is apparently running below twelve in mentality. The rule which is followed throughout is to give the test if there is the least possibility of the child's passing it.

TEST VIII.

It is generally agreed that ability to express ideas verbally is a good criterion of intelligence. In the search for a test which

could be used throughout the age series a group of carefully selected definitions was found to be of great value. The words, which were borrowed in most cases from lists previously used, fall into three groups: (1) Terms used in the everyday life of the child—*fork*, *horse*, and *automobile*; (2) Terms of more general significance—*man* and *tree*; (3) Abstract terms—*kindness*, *sweetness*, *charity*, and *justice*. A tenth was added under this group—the difference between a *worm* and a *snake*.

The type of definitions fall into three groups, as suggested by Binet:

1. Simple repetition or silence.
2. Definitions in terms of use.
3. Definitions in terms superior to use.

At first glance the problem of evaluating this series so that it could be used in a point system seemed especially difficult, but the scale which was adopted permits of accurate evaluation in the great majority of cases. Repetition or tautology receives no credit. If definition is in terms of use we allow one point. If the proper class is given, allow one point. For each differentium allow one point. For example, *automobile*, "to ride in," score 1; "a vehicle," score 1; "a vehicle to ride in," score 2; "a self-propelled vehicle," score 3.

Summary of Points in Definition Test. (See also Fig. 10.)

Age	6	7	8	9	10	11	12	13	14
Av.....	3.2	4.3	5.6	6.8	7.7	11.2	12.4	13.8	15.6
M. V.....	1.9	1.5	1.5	1.6	2.5	2.0	2.8	2.6	3.2

TEST IX.

For the final test we employ a set of fifty cards utilizing the rather complex function of discrimination of form and color. The cards are the same size as ordinary playing cards and of five kinds, ten of each kind. Three colors are used—blue, green, and red, and three forms—circle, square, and triangle. (See Fig. 11.) Each card has three spots, blue at the top, green at the centre, and red at the bottom, the variation in the different sets produced by interchanging the forms.

The cards are shown to the subject with this explanation: "Now I want you to sort these cards for me. I'll show you the different kinds there are. This kind, and this kind, etc. Now

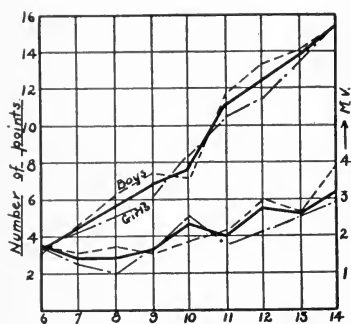


FIGURE 10

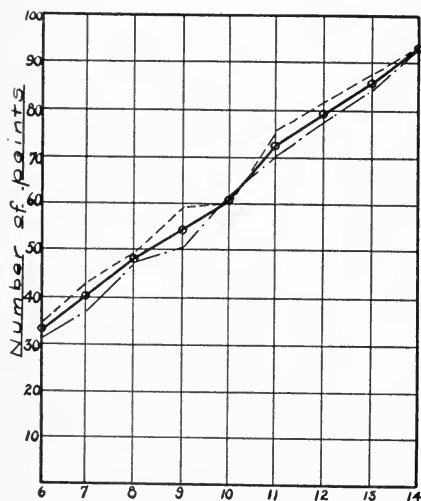


FIGURE 13

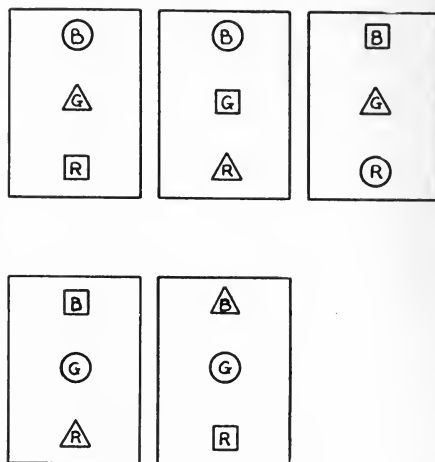


FIGURE 11

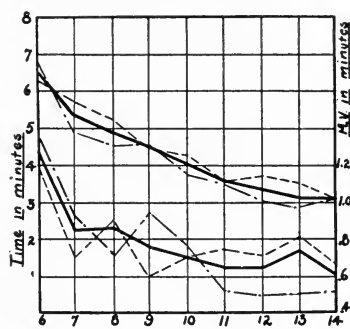


FIGURE 12

then, you are to sort them out, putting the ones that are alike in the same pile. Do you see how they are all different?" Then gathering up the five specimen cards, placing them at the bottom of the pack, all are handed to the child with the remark: "If you find a card and have no place to put it, start a new pile. Just as quickly as you can, now, but don't make any mistakes." A record is taken of the time, number of piles and errors. The latter are rapidly checked by having the similar cards marked on the back with the number of the set. In the table seconds have been converted to minutes. (See Fig. 12.)

Age	6	7	8	9	10	11	12	13	14
Age.....	6.53	5.37	4.86	4.5	4.05	3.56	3.45	3.17	3.10
M. V.....	1.28	.84	.86	.77	.79	.65	.64	.73	.61

EVALUATION OF POINTS FOR THE GRADUATED SCALE

The assigning of weight to the several tests is necessarily an arbitrary matter. The ideal would be to give equal weight to the various mental processes if they could be labelled and tested. But that being impossible, effort was made to distribute the weights to the different tests in a manner which would facilitate, rather than hinder, the task of evaluating the material, while at the same time distributing the points so that the increase from year to year would be as large as possible.

Test I.—Allow one point for each object enumerated.

Test II.—Allow one point for each digit.

Test III.—Divide number of syllables by 4.

Test IV.—Allow two points for each figure correctly drawn.

Test V.—Divide total number of words given by 3.

Test VI.—Divide 100 by the height of the man in feet.

Test VII.—Multiply points made in the seven problems by 3.

Test VIII.—Allow one point for each score as indicated in the description of this test.

Test IX.—Divide 30 by the time take in sorting the cards recorded in minutes.

On this basis the following table is formed from the data given in the several tests:

Summation of Points. (See Fig. 13.)

Test	6	7	8	9	10	11	12	13	14
1	3.3	4.2	4.3	4.9	5.0	5.7	5.7	6.1	6.4
2	4.4	4.9	5.5	5.7	5.6	5.8	6.0	6.1	6.4
3	3.9	4.0	4.3	4.5	4.5	4.7	5.1	5.6	6.0
4	3.6	5.2	6.6	8.0	8.8	10.6	11.2	13.6	15.0
5	4.2	4.7	5.9	7.4	7.4	9.1	10.7	10.0	10.7
6	4.8	4.7	5.5	5.5	5.4	6.9	7.8	7.8	8.6
7	1.5	3.0	4.8	6.0	9.3	11.4	12.4	14.1	15.9
8	3.2	4.3	5.6	6.8	7.7	11.2	12.4	13.8	15.4
9	4.4	5.4	6.8	6.3	7.0	7.9	8.1	8.8	9.0
	<u>33.3</u>	<u>40.0</u>	<u>48.8</u>	<u>55.1</u>	<u>60.6</u>	<u>73.3</u>	<u>79.4</u>	<u>85.9</u>	<u>93.4</u>

By use of interpolation the following table has been constructed from the norms given above and serves the purpose of quickly estimating the ages to a tenth of a year.

No. Points	Ment. Age	No. Points	Ment. Age	No. Points	Ment. Age	No. Points	Ment. Age
33.3	6.0	48.4	8.0	60.6	10.0	79.4	12.0
34.0	6.1	49.1	8.1	61.9	10.1	80.1	12.1
34.7	6.2	49.7	8.2	63.1	10.2	80.7	12.2
35.4	6.3	50.4	8.3	64.4	10.3	81.4	12.3
36.1	6.4	51.1	8.4	65.7	10.4	82.0	12.4
36.9	6.5	51.8	8.5	67.0	10.5	82.7	12.5
37.6	6.6	52.4	8.6	68.2	10.6	83.3	12.6
38.3	6.7	53.1	8.7	69.5	10.7	84.0	12.7
39.0	6.8	53.8	8.8	70.8	10.8	84.6	12.8
39.7	6.9	54.4	8.9	72.0	10.9	85.3	12.9
40.4	7.0	55.1	9.0	73.3	11.0	85.9	13.0
41.2	7.1	55.7	9.1	73.9	11.1	86.7	13.1
42.0	7.2	56.2	9.2	74.5	11.2	87.4	13.2
42.8	7.3	56.8	9.3	75.1	11.3	88.2	13.3
43.6	7.4	57.3	9.4	75.7	11.4	88.9	13.4
44.4	7.5	57.9	9.5	76.4	11.5	89.7	13.5
45.2	7.6	58.4	9.6	77.0	11.6	90.4	13.6
46.0	7.7	59.0	9.7	77.6	11.7	91.2	13.7
46.8	7.8	59.5	9.8	78.2	11.8	91.9	13.8
47.6	7.9	60.1	9.9	78.8	11.9	92.7	13.9
						93.4	14.0

THE BINET-SIMON SCALE
AND THE
YERKES POINT SCALE
A COMPARATIVE STUDY BASED ON THE
EXAMINATION OF 100 CASES

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In the discussion of the reliability of these two scales as means of measuring the intelligence of children, it is assumed that the readers are acquainted with the nature of the scales and the methods of giving the tests.¹ The examination of the one hundred cases for this experiment was made by the writer personally so as to eliminate any possible error that might arise from variation of method by different examiners. The great majority of the examinations were conducted in the Educational Clinic of the College of the City of New York, of which Dr. Samuel B. Heckman is the Director. Some of the examinations were made at the office of the Director of Ungraded Classes of New York. All tests were made under very favorable conditions of environment. The rooms were pleasant, and secluded enough to exclude most of the distracting elements. As a rule in order to eliminate any possible means of distraction for the subject no third person was permitted to witness the examination. Before the tests were given the child was first permitted to work with picture puzzle boards or in the case of very young children was given pictures to look at. This was done in order to establish a perfect *rapport* with the child. After the child was somewhat acquainted with the new surroundings the examination was begun.

Both tests, that is the Binet-Simon and the Point Scale tests, were given at one sitting. The sex and language norms furnished by Prof. Yerkes on page 73 of his book were used. Chart I gives the results obtained from one hundred children examined by the

¹ The Binet-Simon Scale used was that known as the 1911 revision translated by Dr. Clara H. Town, and recommended for clinical use by the conference held at Buffalo in 1914 in connection with the International Congress for School Hygiene. The Point Scale used was that given by Professor Yerkes in his book: *A Point Scale for Measuring Mental Ability*.

Binet-Simon Tests and the Point Scale Tests. All the children attend or at one time attended the public schools. Some of them were in the ungraded class—indicated by a star in front of their number. Each case was numbered so as not to disclose the name. The cases are arranged in the order of increasing chronological age from six to sixteen years. The first column in Chart I gives the case number, the second the sex (M stands for masculine and F for feminine), the third gives the grouping according to language. The letter E in this column means that the child is of English-speaking parents. The letters N. E. mean that the child is of non-English-speaking parents. The fourth column gives the chronological age of the child. The fifth column gives the number of points scored by the child in the Point Scale Tests. The sixth column gives the number of points that a child should score according to its chronological age, or according to the norm for its age. The seventh column gives the coefficient of intellectual ability (C. of I. A.) obtained by dividing the number of points scored in the Point Scale tests by the norm (number of points) for the chronological age, in other words it is the number in the fifth column divided by the number in the sixth column. Column eight gives the mental age of the child in years calculated from the Point Scale norms. Column nine gives the mental age in years according to the Binet tests. Column ten gives the Point Scale status, that is the relationship existing between the chronological age and the mental age. For example a plus 1.5 means that according to the Point Scale tests the child is 1.5 years above normal, a minus 1.5 means that according to the Point Scale the child is 1.5 years below normal. A zero in that column indicates that the mental age according to the Point Scale and the chronological age of the child are the same. Column eleven gives the Binet status, that is the relationship existing between the mental age of the child according to the Binet Scale and the chronological age. The same method of marking is used as in the Point Scale status. Column twelve gives the status difference, that is the difference between the Point Scale status and the Binet-Simon Status. It is found by subtracting the Point Scale status from the Binet status or vice versa. A star in front of any case number indicates that the case was in an ungraded class at the time of examination.

CHART I.

Results of One Hundred Cases Examined by the Binet Scale and the Point Scale

Case No.	Sex	Language	Chron. Age	P. S. Score	P. S. Norm	Coef. I. A.	P. S. Age	Binet Age	P. S. Stat.	Binet Stat.	Status Diff.
46	M	E	6.7	46	33	1.40	8.2	8.6	+1.5	+1.9	.4
76	M	E	7.1	23	33	.69	5.3	6.0	-1.8	-1.1	.7
100	F	NE	7.2	44	30	1.46	8.6	7.8	+1.4	+ .6	.8
82	M	E	7.5	39	33	1.05	7.6	7.6	+ .1	+ .1	0
44	M	NE	7.5	30	32	.93	6.7	6.8	- .8	- .7	.1
89	F	NE	7.7	26	32	.81	5.6	6.4	-2.1	-1.3	.8
38	F	NE	7.8	33	32	.85	7.1	6.8	- .7	-1.0	.3
78	M	E	8.2	31	43	.72	6.5	6.0	-1.7	-2.2	.5
3	M	NE	8.3	25	39	.64	6.0	6.0	-2.3	-2.3	0
51	F	NE	8.3	24	32	.75	5.3	6.6	-3.0	-1.7	1.3
69	M	E	8.7	59	56	1.05	9.3	9.2	+ .6	+ .5	.1
*52	M	NE	9.0	30	46	.65	6.7	6.6	-2.3	-2.4	.1
*18	M	NE	9.0	38	46	.82	7.9	8.4	-1.1	- .6	.5
*22	F	NE	9.3	43	51	.84	8.5	8.6	- .8	- .7	.1
5	M	NE	9.8	53	58	.91	9.6	9.6	- .2	- .2	0
8	M	NE	10.0	43	64	.67	8.0	8.0	-2.0	-2.0	0
*91	M	E	10.0	55	64	.86	8.9	8.4	-1.1	-1.6	.5
61	M	NE	10.3	64	58	1.10	11.6	12.2	+1.3	+1.9	.6
*21	M	E	10.3	15	64	.25	4	5.4	-6.3	-4.9	1.4
81	M	E	10.6	84	66	1.27	14.0	12.0	+3.4	+1.4	2.0
47	M	E	10.7	49	66	.74	8.5	8.8	-2.2	-1.9	.3
98	M	NE	10.7	61	61	1.00	11.0	9.8	+ .3	- .9	1.2
74	M	E	10.8	74	66	1.12	11.9	10.4	+1.1	- .4	1.5
90	M	NE	10.9	55	61	.90	9.7	9.4	-1.2	-1.5	.3
85	M	NE	10.9	50	61	.82	9.3	10.0	-1.6	- .9	.7
6	M	E	11.0	60	66	.90	9.5	9.4	-1.5	-1.6	.1
*32	F	E	11.0	32	63	.50	6.2	7.8	-4.8	-3.2	1.6
99	M	E	11.0	56	66	.85	9.0	9.0	-2.0	-2.0	0
66	M	E	11.3	66	66	1.00	11.0	9.8	- .3	-1.5	1.2
70	M	NE	11.3	53	61	.87	9.6	9.2	-1.7	-2.1	.4
88	M	NE	11.5	92	66	1.39	15	14.6	+3.5	+3.1	.4
71	M	E	11.7	68	75	.91	11.2	10.2	- .5	-1.5	1.0
28	M	E	11.7	65	75	.86	10.5	10.0	-1.2	-1.7	.5
31	F	NE	11.7	51	68	.75	9.0	9.4	-2.7	-2.3	.4
43	M	E	12.0	64	75	.85	10.0	10.0	-2.0	-2.0	0
25	M	NE	12.0	69	66	1.04	13.1	10.0	+1.1	-2.0	3.1
97	M	E	12.0	57	75	.76	9.1	9.6	-2.9	-2.4	.5
*24	M	NE	12.3	56	66	.84	9.8	9.6	-2.5	-2.7	.2
62	M	NE	12.4	61	66	.92	11.0	9.6	-1.4	-2.8	1.4
63	M	E	12.6	84	82	1.02	14.0	12.0	+1.4	- .6	2.0
77	M	E	12.6	62	82	.76	9.7	10.0	-2.9	-2.6	.3
40	M	E	12.6	51	82	.62	8.6	9.0	-4.0	-3.6	.4
39	M	E	12.7	40	82	.48	7.7	8.0	-5.0	-4.7	.3
30	F	E	13.0	66	77	.85	11.2	9.8	-1.8	-3.2	1.4
9	M	NE	13.0	51	68	.75	9.4	9.2	-3.6	-3.8	.2
*17	M	E	13.0	59	82	.71	* 9.4	9.2	-3.6	-3.8	.2
26	M	NE	13.0	71	68	1.02	13.5	10.2	+ .5	-2.8	3.3
2	M	E	13.0	83	82	1.00	13.5	14.6	+ .5	+1.6	1.1
49	M	E	13.0	75	82	.91	12.0	10.4	-1.0	-2.6	1.6
*67	M	E	13.0	44	82	.54	8.0	8.2	-5.0	-4.8	.2
35	M	E	13.0	81	82	.99	12.8	12.2	- .2	- .8	.6
64	M	NE	13.0	44	68	.65	8.7	8.6	-4.3	-4.4	.1
56	M	NE	13.4	65	68	.95	11.8	10.2	-1.6	-3.2	1.6

CHART I.—Continued.

Case No.	Sex	Language	Chron. Age	P. S. Score	P. S. Norm	Coef. I. A.	P. S. Age	Binet Age	P. S. Stat.	Binet Stat.	Status Diff.
45	F	NE	13.5	51	75	.68	9.0	9.4	-4.5	-4.1	.6
60	M	NE	13.5	76	68	1.11	14.5	11.6	+1.0	-1.9	2.9
59	M	E	13.6	74	84	.88	11.9	11.8	-1.7	-1.8	.1
83	M	E	13.6	94	84	1.12	15	14.6	+1.4	+1.0	.4
37	M	NE	13.6	64	74	.87	11.6	10.0	-2.0	-3.6	1.6
27	M	E	13.6	86	84	1.02	15.0	12.2	+1.4	-1.4	2.8
42	M	NE	13.6	56	74	.75	9.8	10.2	-3.8	-3.4	.4
11	M	E	13.7	85	84	1.01	14.5	11.8	+ .8	-1.9	2.7
50	M	NE	13.7	80	74	1.08	15	10.8	+1.3	-2.9	4.2
33	M	E	13.8	64	84	.76	10.0	10.0	-3.8	-3.8	0
58	M	NE	13.8	67	74	.90	12.5	10.2	-1.3	-3.6	2.3
80	M	NE	13.8	62	74	.83	11.2	11.8	-2.6	-2.0	.6
20	M	NE	13.8	58	74	.78	10.0	9.6	-3.8	-4.2	.4
13	M	E	14.0	38	84	.45	7.5	7.8	-6.5	-6.2	.3
72	M	NE	14.0	56	74	.76	9.8	10.0	-4.2	-4.0	.2
36	M	NE	14.0	58	74	.78	10.0	9.8	-4.0	-4.2	.2
*16	M	NE	14.0	64	74	.86	11.6	9.2	-2.4	-4.8	2.4
4	M	NE	14.1	42	74	.56	8.4	8.0	-5.7	-6.1	.4
1	M	E	14.3	80	84	.95	12.7	12.2	-1.6	-2.1	.5
87	M	NE	14.4	64	74	.86	11.6	11.6	-2.8	-2.8	0
*23	M	NE	14.5	49	74	.66	9.2	8.8	-5.3	-5.7	.4
*19	M	E	14.5	73	84	.86	11.8	10.2	-2.7	-4.3	1.6
34	M	E	14.6	91	86	1.05	15	12.4	+ .4	-2.2	2.6
86	M	E	14.6	74	86	.86	11.9	11.6	-2.7	-3.0	.3
54	M	E	14.6	43	86	.50	8.0	8.8	-6.6	-5.8	.8
7	M	E	14.7	68	86	.79	11.2	10.4	-3.5	-4.3	.8
94	M	E	14.7	92	86	1.06	15	12.4	+ .3	-2.3	2.6
96	M	E	14.7	71	86	.82	11.5	12.0	-3.2	-2.7	.5
65	M	NE	14.8	58	78	.73	11.8	10.0	-3.0	-4.8	1.8
79	M	NE	14.9	54	78	.69	9.7	9.6	-5.2	-5.3	.1
10	M	NE	15.0	57	78	.73	9.9	9.4	-5.1	-5.6	.5
29	M	E	15.0	57	86	.66	9.1	9.4	-5.9	-5.6	.3
15	M	NE	15.0	78	78	1.00	15.0	11.8	0.0	-3.2	3.2
75	M	E	15.1	80	86	.93	12.7	12.2	-2.4	-2.9	.5
68	M	E	15.2	88	86	1.02	15	14.6	0.0	- .6	.6
93	M	E	15.2	71	86	.82	11.5	11.6	-3.7	-3.6	.1
84	M	E	15.4	59	86	.69	9.4	9.8	-6.0	-5.6	.4
92	M	E	15.4	73	86	.85	11.8	12.0	-3.6	-3.4	.2
95	M	E	15.4	78	86	.91	12.4	12.2	-3.0	-3.2	.2
14	M	E	15.5	72	86	.84	11.3	10.4	-4.2	-5.1	.9
55	M	E	15.5	75	86	.87	12.0	12.2	-3.5	-3.3	.2
57	M	NE	15.5	71	78	.91	13.6	10.2	-1.9	-5.3	3.4
12	M	NE	15.5	80	78	1.02	15	11.8	+ .5	-3.7	3.2
41	M	E	15.7	82	86	.95	13.0	12.0	-2.7	-3.7	1.0
53	M	E	15.8	74	86	.86	11.9	10.4	-3.9	-5.4	1.5
73	M	E	16.0	76	86	.88	12.1	12.0	-3.9	-4.0	.1
48	M	NE	16.0	65	80	.80	11.8	12.0	-4.2	-4.0	.2

The one hundred cases whose data is furnished in Chart I may be divided for purposes of discussion into three groups, viz.:

1. Those sent by teachers or principals of the public schools;
2. Those sent by the Bureau of Attendance;
3. Those sent by parents.

The first group includes those children who failed to make satisfactory progress in the regular grades and were sent for examination to ascertain whether it would be advisable to place them in an ungraded class. This group also includes children who at the time of the examination were in an ungraded class. They were examined to determine whether they were fit to return to the regular grades. The second group includes children who are truants. They were examined in order to ascertain their mental status. Those who were found to be feeble-minded were recommended for an ungraded class, those who were normal were held responsible for their truancy and were either put on parole or committed to a truant school. The third group includes those children sent by their parents because of irregularities in behavior and unsatisfactory mental progress. A great many more tests than the Binet-Simon and the Point Scale were given in making a diagnosis, but these are omitted from this paper. The great majority of the cases examined belong to the first and second groups mentioned. Bearing this in mind one will understand why so many cases fall below their chronological age in both of the tests and also why so few cases measure up to normal.

A survey of columns ten and eleven in Chart I which give the Point Scale status and the Binet Status shows that from the ages seven years to ten years inclusive five individuals are rated by both tests as above age and fourteen individuals are rated as below age. The mental retardation in years according to the Binet Scale ranges from .1 to 6.2; according to the Point Scale tests from .1 to 6.6 years. From eleven to sixteen years inclusive, 4 individuals are rated above age and 77 below age by the Binet Tests whereas by the Point Scale tests 16 individuals are rated above age, 2 are rated as of normal age and 63 individuals are rated as below age. The mental retardations expressed in years, from eleven to sixteen years inclusive according to the Binet Tests, range from .4 to 6.2; according to the Point Scale tests from .2 to 6.6 years. These results indicate that the Binet Tests are a reliable means of determining the mentality of chil-

CHART II.

Analysis of the 100 cases giving the age difference according to the Binet Scale and the Point Scale, also the Binet Intelligence Quotient and the Point Scale Coefficient of Intellectual Ability

7 Years				8 Years				9 Years				10 Years				11 Years			
Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.
+1.9	+1.5	1.28	1.40	-1.3	-2.1	.83	.81	+ .5	+ .6	1.06	1.05	- .2	- .2	.98	.91	+1.4	+3.4	1.13	1.27
-1.1	-1.8	.84	.69	-1.0	- .7	.87	.85	-2.4	-2.3	.73	.65	-2.0	-2.0	.80	.67	-1.9	-2.2	.82	.74
+ .6	+1.4	1.08	1.46	-2.2	-1.7	.73	.72	- .6	-1.1	.93	.82	-1.6	-1.1	.84	.86	- .9	+ .3	.91	1.00
+ .1	+ .1	1.01	1.05	-2.3	-2.3	.72	.64	- .7	- .8	.92	.84	+1.9	+1.3	1.18	1.10	- .4	+1.1	.96	1.12
- .7	- .8	.90	.93	-1.7	-3.0	.79	.75					-4.9	-6.3	.52	.23	-1.5	-1.2	.86	.90
																- .9	-1.6	.91	.82
																-1.6	-1.5	.85	.90
																-3.2	-4.8	.71	.50
																-2.0	-2.0	.82	.85
																-1.5	- .3	.87	1.00
																-2.1	-1.7	.81	.87
																+3.1	+3.5	1.27	1.39

12 Years				13 Years				14 Years				15 Years				16 Years			
Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.	Bin. Yrs. +	P. S. Yrs. +	Bin. I. Q.	P. S. C.I.A.
-1.5	- .5	.87	.91	- .6	+1.4	.95	1.02	-1.8	-1.7	.86	.88	-2.2	+ .4	.85	1.05	-3.7	-2.7	.76	.95
-1.7	-1.2	.85	.86	-2.6	-2.9	.79	.76	+1.0	+1.4	1.07	1.12	-3.0	-2.7	.79	.86	-5.4	-3.9	.66	.86
-2.3	-2.7	.80	.75	-3.6	-4.0	.71	.62	-3.6	-2.0	.73	.87	-5.8	-6.6	.60	.50	-4.0	-3.9	.75	.88
-2.0	-2.0	.83	.85	-4.7	-5.0	.63	.48	-1.4	+1.4	.89	1.02	-2.3	-3.5	.70	.79	-4.0	-4.2	.75	.80
-2.0	+1.1	.83	1.04	-3.2	-1.8	.75	.85	-3.4	-3.8	.75	.75	-2.3	+ .3	.84	1.06				
-2.4	-2.9	.80	.76	-3.8	-3.6	.70	.75	-1.9	+ .8	.86	1.01	-2.7	-3.2	.81	.82				
-2.7	-2.5	.78	.84	-3.8	-3.6	.70	.71	-2.9	+1.3	.77	1.08	-4.8	-3.0	.67	.73				
-2.8	-1.4	.77	.92	-2.8	+ .5	.79	1.02	-3.8	-3.8	.72	.76	-5.3	-5.2	.64	.69				
				+1.6	+ .5	1.12	1.00	-3.6	-1.3	.74	.90	-5.6	-5.1	.62	.73				
				-2.6	-1.0	.80	.85	-2.0	-2.6	.85	.83	-5.6	-5.9	.62	.66				
				-4.8	-5.0	.63	.54	-4.2	-3.8	.69	.78	-3.2	-3.2	.78	1.00				
				- .8	- .2	.94	.99	-6.2	-6.5	.56	.45	-2.9	-2.4	.81	.93				
				-4.4	-4.3	.66	.65	-4.0	-4.0	.71	.76	- .6	0.0	.95	1.02				
				-3.2	-1.6	.76	.95	-4.2	-4.2	.70	.78	-3.6	-3.7	.76	.82				
				-4.1	-4.5	.69	.68	-4.8	-2.4	.66	.86	-5.6	-6.0	.63	.69				
				-1.9	+1.0	.85	1.11	-6.1	-5.7	.57	.56	-3.4	-3.6	.77	.85				
								-2.1	-1.6	.85	.91	-3.2	-3.0	.79	.91				
								-2.8	-2.8	.80	.86	-5.1	-4.2	.67	.84				
								-5.7	-5.3	.54	.66	-3.3	-3.5	.79	.87				
								-4.3	-2.7	.70	.86	-3.7	+ .5	.69	.91				
														.76	1.01				

dren who are ten years of age or below. After ten years the Binet-Simon results are not very reliable. This is to be expected since there are no tests for eleven, thirteen and fourteen years.

A survey of the last column of Chart I, which gives the status difference, shows that in eight cases the results of both scales were identical, in twenty additional cases the results did not differ more than by two tenths (.2) of a year, in twenty-eight additional cases the results did not differ more than by five-tenths (.5) of a year, and in thirteen additional cases the results did not differ more than by one year. The greatest difference in the results of the two scales was for the years eleven to sixteen inclusive. Chart II analyzes the 100 cases under their respective age groups, giving the age difference of each case according to the Binet Scale and the Point Scale, and the Binet Intelligence Quotient and the Point Scale Coefficient of Intellectual Ability.

Chart III summarizes the results of the 100 cases as they appear in Chart II. The results are listed under each year. It should be noted that seven years includes the ages 6.6 to 7.5 years, eight years includes the ages 7.6 to 8.5 years, etc. Under each year there are three columns. The first column gives the number of individuals rated as advanced, the second column gives the number of individuals rated as normal, the third column gives the number of individuals rated as retarded. At the end of each group is given the average departure from age according to both tests.

CHART III

Results of 100 Cases Examined by the Binet-Simon Scale and the Point Scale

Average Departure from Age																					
			7 Years			8 Years			9 Years			10 Years									
			Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Posi- tive	Nega- tive					
Binet Scale	3	0	2	0	0	5	1	0	3	1	0	4	1.00	1.62							
Point Scale	3	0	2	0	0	5	1	0	3	1	0	4	.98	1.87							
			11 Years			12 Years			13 Years			14 Years			15 Years			16 Years		Average Departure from Age	
			Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Ad.	Norm.	Ret.	Posi- tive	Nega- tive		
Binet Scale	2	0	10	0	0	8	1	0	15	1	0	19	0	0	21	0	0	4	1.77	3.08	
Point Scale	4	0	8	1	0	7	4	0	12	4	0	16	3	2	16	0	0	4	1.22	3.12	

Chart III further indicates what was said before, namely that the findings of the two scales run parallel till the age of ten. Hence we may assume that both scales are reliable till that age. Chart IV combines the results of the 100 cases irrespective of age.

CHART IV.

Results of 100 Cases Examined by the Binet-Simon Scale and the Yerkes Point Scale

	Advanced	Normal	Retarded	Average Departure from Age	
				Positive	Negative
Binet.....	9	0	91	1.34	2.86
Point Scale.....	21	2	77	1.16	2.89

The conclusions to be drawn from the comparison of the two scales are:

1. That the results are practically identical for the first ten years.

2. That the reliability and fairness of the Binet Scale greatly decreases after the tenth year.

3. That the reliability and fairness of the Point Scale continue and therefore the Point Scale demonstrates its superiority over the Binet Scale for at least four years beyond the point where the reliability of the Binet Scale ceases.

Where the results of both scales agree, the examiner with considerable degree of certainty may feel that the mental age of the child as determined by the two scales is correct, where the results of both scales differ to any marked extent, this divergence of results may serve two valuable purposes: first, it prevents over hasty conclusions on the part of the examiner, and, secondly, it makes clear the need of supplementary tests before a definite diagnosis is made.

AN ANNOTATED BIBLIOGRAPHY OF RECENT LIT-
ERATURE ON THE BINET-SIMON SCALE
(1913-1917). PART III.

SAMUEL C. KOHS

Research Fellow under the Buckel Foundation, Leland Stanford Jr. University

298. PEARSON, KARL, AND JAEDERHOLM, GUSTAV A.: *Questions of the Day and of the Fray.—No. VIII. Mendelism and the Problem of Mental Defect.—II. On the Continuity of Mental Defect.*

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EDITORIAL

The conduct of a war in these modern times is a big task—how big we are just beginning to realize. Modern war is not merely the shock of battle, although all other activities lead up to this,—it is organization, transportation and utilization of resources.

That our government seems to appreciate this is a matter for satisfaction. We have not been a warlike nation. We have paid little attention to the art of war. That we should make mistakes is to be expected. But the men at Washington seem disposed to profit by experience and to make use of all the expert advice they can obtain. Particularly encouraging is their recognition of the importance of psychological factors in military organization, and their readiness to make practical application of psychological technique.

In the matter of the draft, for example, the principle of universal liability to service is unquestionably sound and consistent with the principles of democracy. But the haphazard fashion in which the first contingent of the draft was selected gave rise to great inequalities of treatment and much discussion. It is now proposed that every registered man who has not yet been called to the colors shall

file with his local board a complete account of himself, including life-history, family, training, responsibilities, and economic value to the state. On the basis of this record the men will be divided into five classes. Class 1, composed of those who have no dependents and who are not engaged in important pursuits, will be called first until the entire class is exhausted. Class 2, involving men with small families, or those engaged in partly skilled occupations, will come next. Then will follow Class 3, highly skilled men or those with aged dependents, Class 4, men having large families or holding important positions, and Class 5, men in no way fitted for active service. Plans are being devised which will greatly facilitate the keeping of the records, the physical examination of the men (which will take place only after they are called), and the organization of the contingents.

The application of psychological tests to the men of the first contingent is proceeding apace in four of the cantonments. In each cantonment the work is in charge of four commissioned officers (psychologists) and six civilians, as follows:

Camp Devens, Ayer, Mass. First Lieutenants W. S. Foster, J. E. Anderson, H. B. English, J. T. Metcalf, civilians R. H. Wheeler, H. C. Bingham, C. R. Brown, C. E. Kellogg, R. S. Roberts, C. H. Toll.

Camp Dix, Wrightstown, N. J. First Lieutenants J. W. Hayes, H. A. Richmond, H. T. Manuel, C. C. Brigham, civilians T. H. Haines, N. J. Melville, H. P. Shumway, T. M. Stokes, J. J. B. Morgan, C. C. Stech.

Camp Lee, Petersburg, Va. First Lieutenants C. S. Yoakum, G. O. Ferguson, Jr., W. S. Hunter, E. S. Jones, civilians L. T. Brueckner, D. G. Paterson, A. S. Edwards, R. Pintner, B. F. Pittenger, B. D. Wood.

Camp Taylor, Louisville, Ky. First Lieutenants M. R. Trabue, K. T. Waugh, H. B. Cummings, E. A. Doll, civilians J. W. Bridges, J. Crosby Chapman, J. K. Norton, E. C. Rowe, J. D. Houser, and C. P. Stone.

The entire work is under the supervision of Major R. M. Yerkes, with Professor W. V. Bingham as civilian assistant. The aims of this testing are to furnish commanding officers with a list of the rating of each man in his command, by which he may, if he chooses, be guided in selecting men for promotion, or for special duties requiring more than average intelligence and mental quickness, to pick out those who are so deficient in intelligence as to require further psychiatric examination, and to determine special aptitudes and capacities.

Further, Professors Bingham, Scott, and others are at work on an occupational classification of recruits, Professors Angell and Scott are devising scales for the rating of officers, Professor Watson and assistants are working on problems of aviation, and Professor Dodge is studying the psychology of gun pointing and cognate problems in the handling of artillery. Thus it will be seen that psychology is giving of its best in the service of the nation.

J. C. B.

NOTES AND NEWS

The next annual meeting of the American Psychological Association, which was to have been held at Ann Arbor, will be held instead at Pittsburgh, December 27-29, 1917.

Extensive tests of the musical ability of fifth grade school children are being carried on under the supervision of Professor C. E. Seashore, of the University of Iowa. The fifth grade has been selected for these tests because in this grade the children are old enough to understand what is wanted of them and to coöperate in the testing, and still young enough to permit of a thorough education in music if the results of the tests indicate the presence of a considerable degree of ability. The tests have been introduced into several Iowa cities, and the schools of St. Louis. Last summer in connection with Professor Seashore's courses in the University of California large groups of children from Berkeley and San Francisco were examined, and teachers were trained in the use of the tests. If these tests can be given annually to selected groups of children for perhaps ten years, and the results of their musical training carefully followed up, we shall have a mass of material on the development of a specific ability that will be of the highest psychological and educational value.

Professor John B. Watson, of Johns Hopkins University, has accepted a commission in the United States Army with the rank of major for the purpose of applying psychological principles to the task of the selection of aviators. Dr. Watson will be assisted by a strong corps of psychologists and physiologists, and will endeavor to determine the characteristics of the successful aviator, and the most efficacious means of selecting promising candidates.

Professor James R. Angell, of the University of Chicago, has been granted a leave of absence from that institution to devote himself to the problem of selecting from the new national army those who should be withdrawn for special schooling to serve as officers.

Professor B. B. Breese, of the University of Cincinnati, desires to call attention to an error in his recently published text-book in psychology. In Fig. 29, opposite page 48, the lower and smaller blue area near the hippocampal convolution should be in purple instead of blue. The error was made in the process of engraving, and was discovered by the publisher only after the first lot of books had been issued.

Professor Bird T. Baldwin, head of the department of psychology and education at Swarthmore College and lecturer on education at Johns Hopkins University, has accepted the position of director of the Child Welfare Research Station, and research professor of educational psychology at the University of Iowa.

In the Chicago Public Schools Dr. Frank G. Bruner, of the Child Study department, has been appointed director of special schools.

Dr. David Allen Anderson, associate professor of education in the University of Washington, has been called to the headship of the department of education and psychology in the Pennsylvania State College.

Three Iowa college professorships in psychology for the current year have been filled by students from the graduate college of the State University of Iowa. Dr. Marie Agnew goes to Buena Vista, Dr. Merle Thompson goes to Morningside, and Dr. Nesta Williams has accepted a professorship at Central College.—*School and Society*.

Dr. Raymond H. Wheeler, instructor in psychology in the University of Oregon, has been promoted to an assistant professorship in that institution.

Dr. Arthur C. Fleshman, of Kentucky State University, has been appointed professor of education in the University of West Virginia.

Professor F. A. C. Perrine, assistant professor of psychology at the University of Pittsburgh, has accepted the position of adjunct professor of psychology at the University of Texas.

Dr. John F. Dashiell has been appointed instructor in psychology at Oberlin College.

PUBLICATIONS RECEIVED

ALFRED ADLER. *The Neurotic Constitution. Outlines of a Comparative Individualistic Psychology and Psychotherapy.* Authorized translation by Bernard Glueck and John E. Lind. New York: Moffat, Yard and Company, 1917. Pp. xxvi, 456. \$3.00.

The author divides his discussion into two parts. The first or theoretical part sketches the development of the feeling of inferiority, which is such a striking characteristic of the neurotic individual. Emphasis is laid on the principle of psychic compensation by which the neurotic subject endeavors to raise himself above and triumph over the felt inferiority; the accentuated fiction thus becomes systematized and idealized as a source of safety and security. Part two, which is called the practical part, gives a somewhat detailed account of the characteristic symptoms of neurotic subjects, as avarice, suspiciousness, envy, cruelty, and so on through the whole list of anomalies of disposition which a study of neurotics reveals. As the normal individual crystallizes his experiences into ideals, principles, standards of conduct, and thus gradually builds up his character, so the neurotic, oppressed by the ever present consciousness of his unworthiness, elaborates a complicated system of fictions, which in turn react upon every day experiences and frequently drive the subject to the meanest and most despicable types of conduct. Neurotics cling to these reassuring ideals with great tenacity, for to acknowledge their falsity would be to show one's self to the world in all one's miserable weakness. As the author says in conclusion "Inferior organs and neurotic phenomena are symbols of formative forces which strive to realize a self-conducted life-plan by means of intense efforts and expedients."

AUGUSTA F. BRONNER. *The Psychology of Special Abilities and Disabilities.* Boston: Little, Brown and Company, 1917. Pp. vii, 269. \$1.75.

"In this book an attempt has been made to discuss practical aspects of special abilities and disabilities, to offer in detail methods of attacking problem cases, and to present various types, both (a) of particular disabilities in those who have normal general ability and (b) of particular abilities of those who are below normal in general capacities." The author states first the general method of procedure in reaching a diagnosis, discusses some general educational tendencies, and then gives a detailed account of individual cases exhibiting defects in number work, in language ability, in separate mental processes, and in mental control. There is one chapter on "Special Abilities with General Mental Sub-Normality." The author believes that the various means employed by schools to meet the situations caused by these individual disabilities, such as ungraded classes,

"floating teachers," promotion by subjects, are helpful but inadequate. We need a more careful and thorough educational diagnosis of the individual pupil and an adjustment of school tasks to fit his particular needs.

HENRY PRATT FAIRCHILD. *Outline of Applied Sociology*. New York: The Macmillan Company, 1916. Pp. x, 353. \$1.75.

This book "concerns itself but little with questions of origins, and devotes itself to facts rather than to theories." The five parts of which the book is composed deal with the following topics: (1) Classification of social phenomena and types of abnormality, as immorality, sin, crime, vice, incapacity, maladjustment; (2) The normal aspects of economic life, including such ideas as natural liberty, competition, the relations between capital and labor, transportation, standards of living, economic abnormalities and their remedies; (3) The growth of population, involving a discussion of marriage, the family, divorce, sexual relations, the child, and schemes of betterment; (4) The esthetic, intellectual, and spiritual life; and (5) The dominance of the interests of society over those of any and all individuals. Very applicable is the pithy statement of Professor Sumner "If this poor old world is as bad as they say, one more reflection may check the zeal of the headlong reformer. It is at any rate a tough old world."

GEORGE GORHAM GROAT. *An Introduction to the Study of Organized Labor in America*. New York: The Macmillan Company, 1917. Pp. xv, 494. \$1.75.

The topics considered in this excellent history are the beginnings of organized labor in England and America, modern industrialism, the history of such organizations as the Knights of Labor, the American Federation of Labor, the American Trade Union, and the attitude of women toward the unions. There are extended discussions of the strike, the boycott, the closed shop, arbitration, trade agreements, and the restriction of membership and output. The political activity of labor organizations is illustrated at some length and the transitional stages of industrial unionism and syndicalism are examined with reference to their influence on the future of organized labor. In view of the industrial readjustments that will follow the conclusion of peace this book deserves to be read and pondered by all interested in the employment of labor.

G. STANLEY HALL. *Jesus, the Christ, in the Light of Psychology*. New York: Doubleday, Page and Company, 1917. Volume I, pp. xix, 325. Volume II, pp. 326 to 733. \$7.50.

In this imposing work we have not merely a psychologist's reaction to the fundamental problems of Christianity, but the results of a long life of sympathetic reflection upon and study of these problems. The argument of the volumes is not destructive of Christian

faith, but rather constructive and interpretive. The author says "I believe I can now repeat almost every clause of the Apostles' Creed with a fervent sentiment of conviction. My intellectual interpretation of the meaning of each item of it probably differs *toto caelo* from that of the average orthodox believer. To me not a clause of it is true in a crass, literal, material sense, but all of it is true in a sense far higher, which is only symbolized on the literal plane. The change from my boyhood belief in it all has been to me all gain and no loss.

JOHN A. LAPP AND CARL H. MOTE. *Learning to Earn. A Plea and a Plan for Vocational Education*. Indianapolis: The Bobbs-Merrill Company, 1915. Pp. 421. \$1.25.

Both secondary and elementary education are still under the influence of humanistic formalism. The present book is designed to stir up popular interest in the reform of elementary education in the direction of better preparation for the business of living. For such a purpose novelty would be undesirable and we find a straightforward presentation of present tendencies and desirable ideals in vocationalizing education. The last chapter on the "Ideal School" stresses the social purpose of education and urges a corresponding socialization of the school procedure.

LAURA F. KREADY. *A Study of Fairy Tales*. Boston: Houghton Mifflin Company, 1916. Pp. xvii, 313.

The last decade has witnessed a noteworthy revival of interest in fairy tales as introductory material for the study of literature. Their use is advocated because of the pleasure they afford to children, because of the stimulus they give to the imagination, because they extend and intensify the child's social and moral ideas, and because they furnish convenient and flexible material for language training. The present book will be very useful to elementary teachers for its discussion of the principles of selection of fairy tales, its instruction in story telling, its presentation of the history of fairy tales, and its extensive lists of source materials. It is a book worth owning and studying.

THOMAS MOTT OSBORNE. *Society and Prisons*. New Haven, Conn.: Yale University Press, 1916. Pp. 246. \$1.35.

This volume presents the author's "Yale Lectures on the Responsibilities of Citizenship" on the William Earl Dodge Foundation. Probably no one in this country has made more extensive investigations of prison conditions or has had a better opportunity to prove the absurdities of traditional penology. While it is undoubtedly true that striking advances have been made in the treatment of criminals, society is still in the grip of the barbaric idea that the criminal must suffer punishment. But from a social point of view the two things needful are, first, protection from the anti-social behavior of

the criminal, and second, the reform of the criminal into a productive and reliable citizen. The first of these ends is best attained by the scientific study of individuals who manifest anti-social tendencies before these develop to the criminal stage. By a proper education or segregation as wards of the state probably half of the crime now committed might thus be avoided. In cases of the actual conviction of crime the criminal should not only be deprived of his liberty as a punishment, but should immediately be studied to determine whether or no the capacity of social self-control may be developed. If it can, treatment should immediately be directed to the establishment of a proper attitude toward society, and the man instead of being a burden to the state should be put at productive labor under social guidance and direction. The present book will contribute no insignificant share to the realization of these ideals.

FREDERIC DEWITT WELLS. *The Man in Court*. New York: G. P. Putnam's Sons, 1917. Pp. vii, 283. \$1.50.

The author, who is a justice of the municipal court of New York City, draws a humorous but vivid and enlightening picture of various phases of court procedure. Some of the scenes presented are A Night Court, The Civil Court, The Judge, The Anxious Jury, The Strenuous Lawyer, The Worried Client, The Confused Witness, The Heavy Charge, and The True Verdict. The final chapter, entitled Looking Backward, is an imaginative extract from the graduation dissertation of a Columbia juridical expert in 1947. By this device the author is able to point out the changes in legal procedure that he believes to be most urgently needed.

AGNES MATHILDE WERGELAND. *Slavery in Germanic Society During the Middle Ages*. Chicago: The University of Chicago Press, 1916. Pp. xvi, 158. \$1.00.

In this little book we find a careful study of the sources relating to slavery in early and mediaeval Germany, the laws and customs determining the status of the slave, and the various ways in which the slave might regain his freedom. It is a very interesting and well wrought book.

ALBERT BENEDICT WOLFE, Editor. *Readings in Social Problems*. Boston: Ginn and Company, 1916. Pp. xiii, 804. \$2.80.

The selections in this book deal with five types of social problems, as follows: Problems of population, of immigration, the woman problem, marriage and divorce, and the negro problem in the United States. In the first group Malthus' theory on the ratio of increase in population to food is presented, and there are extracts from various writers on the declining birth rate, socialism and population, eugenics, and infant mortality. Under immigration the im-

portant factors are the economic aspects of the problem, the assimilation of the immigrant, and various proposals for the regulation and restriction of immigration. Under the woman problem the selections deal with the development of the woman's rights movement and contemporary changes affecting the status of women and the education of women. The religious conception of marriage is contrasted with the civil idea of a social contract, and uniform divorce legislation is urged. It will be of great convenience to students to have all these selections brought together in a single volume.

FREDERIC LYMAN WELLS. *Mental Adjustments*. New York: D. Appleton and Company, 1917. Pp. xv, 331. \$2.50.

Professor Joseph Jastrow, editor of The Conduct of Mind Series in which this book appears, writes in his introduction to it, "The reader will pursue the volume with two increasing convictions. The first is that the emotional life is far more central in human regulation than we are wont to recognize. By reason of the deeper rooting of the emotional life in the vital sources of energy, is its adjustment at once dependent upon the integrity of primitive satisfaction. It likewise pervades all derivative expressions of longing and satisfaction. Human nature as it transcends must also incorporate. The other conviction is similar to it: that beliefs, tendencies, inclinations, however intellectually expressed, are more complex than cold objective ideas. Optimism or pessimism is more a temperament than a conviction." The chapters deal with mental adaptation, use and waste in thought and conduct, symbolic association, the continuity of emotion, types of dissociation, mechanisms in dissociated ideas, experimental approaches, and balancing factors. The author makes frequent references to recent psychological investigations and masses his data to reinforce his argument in masterly fashion.

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

DISTRIBUTION OF GRADES

J. L. ZERBE

University of Pittsburgh

In April, 1915, a few weeks before the grading of the work of the night students and a month or so before the final grading of the day students of the School of Applied Industries, Carnegie Institute of Technology, the author, with the approval of the Dean, presented a report to the faculty showing the distribution of 28,257 grades, covering the two semesters, 1912-13, 1913-14, the first semester 1914-15 and the grades of all who had graduated from this school. In the letter of transmission to the Dean, which accompanied the report to the faculty, it was stated: "It is thought that this information in the hands of the faculty at this time will insure a more uniform distribution of grades for the final records of this term." The present paper is to indicate the results of this report on the final grading of the work of the second semester.

Space does not permit the publication of the report in its entirety but a summary of facts and the emphasis placed on the matter will be given. In the report the following tabulations were illustrated by graphs.

Total Distribution in Per Cents

Grade	1912-13	1913-14	1st Sem. 1914-15	Graduates	Total
H ¹	5%	4%	4%	12%	7%
M.....	16	17	17	14	16
C.....	42	39	44	55	43
P.....	14	14	16	16	15
F.....	9	9	8	2	8
D.....	5	4	5	1	4
R.....	6	5	5		4
Fa.....	3	8	1		4

The unsatisfactory grades are bracketed and indicate that a large percentage fail to do satisfactory work and that a great waste of teaching energy must result when so large a percentage of failures is due to absences. The survival of the fittest is shown in the grades assigned the graduates.

A more detailed study suggests a separation of the grades assigned for the day and night courses and is here presented.

	1912-13		1913-14		1st Sem. 1914-15	
	Day	Night	Day	Night	Day	Night
H.....	3%	8%	3%	6%	4%	4%
M.....	15	14	17	17	16	19
C.....	46	35	45	33	46	37
P.....	15	12	15	12	17	15
F.....	10	9	10	9	9	6
D.....	3	7	3	5	4	6
R.....	4	9	5	4	3	8
Fa.....	4	7	2	14	1	5
	21		20		17	
	32		32		25	

The close proximity of the distribution for the day and night courses respectively from year to year indicates that the grading for the day and the night students ought to be based on different standards.

Different standards for the type of work is indicated by a study of the grades assigned for academic work and those for the shop work. Because of the uniformity of distribution from year to year a detailed study was made only of the term 1913-14. The following tabulation shows difference of grading used by academic teachers and shop instructors.

	H	M	CO	P	F	D	R	Fa
Practical or shop course.....	5	19	49	12	5	6	2	1
Summarizing total.....	25		49			26		
Theoretical or academic.....	3	16	30	16	12	5	7	13
Summarizing total.....	19		30			51		

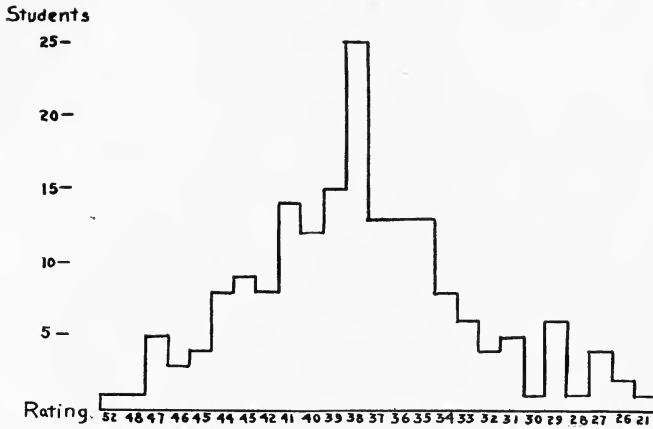
If fifty-one per cent. of all grades assigned is valued as passing or below, as is indicated for the academic subjects, is it not to be inferred that the standard is too high for the class of students taking the work? The combined judgment of the fifty-five instructors considered in 1913-14, is that twenty-six per cent. of all grades assigned is below passing, while the distribution for the passing grades by the individual instructors ranges from fifty-five to two per cent. of all grades granted by the respective instructors.

From the difference in the distribution of the grades for the practical work from that of the academic subjects, it might be inferred that the students are a specialized group and emphasise

¹ The manual of instructions concerning grades and ratings issued by the Carnegie Institute of Technology presents the following valuation for the letters used: Honor (H) 95 to 100 per cent.; Merit (M) 85 to 94 per cent.; Credit (C) 70 to 84 per cent.; Passed (P) 60 to 69 per cent.; Failure (F) 40 to 59 per cent.; Repeat (R) 0 to 39 per cent.; Deferred (D) Work unfinished for reasons satisfactory to the Dean. Failure due to Absence (Fa) is used by some instructors and is not found in the manual.

Distribution of rank standing of 183
First Year Students
Mental Tests

Plate I



the motor rather than the mental side of their training; or that they, perhaps, do not represent the average in mental ability. Since the academic curve is skewed toward the failure point it might be further argued that they have not the mentality nor the training to properly pursue the academic subjects. Plate 1 shows a distribution of mental ability as determined by a series of psychological tests given to one hundred eighty-three first year students, whose scholastic grades or class standing has been considered in the above figures. The graph is constructed from the distribution of ability for distracted² and undistracted³ attention, ability to interpret written⁴ and oral⁵ instructions, immediate memory under distraction,⁶ logical memory,⁷ association,⁸ vocabulary,⁹ learning capacity,¹⁰ constructive imagination,¹¹ judgment,¹² and mental reaction time.¹³ These one hundred eighty-

² Cancellation test, No. 77261—A (Stoelting's catalogue) Whipple's Manual, while listening to reading.

³ Cancellation test, No. 77261—B.

⁴ Woodworth and Wells Test, No. 88072.

⁵ Ability to follow instructions in performing the tests.

⁶ Reproduce from memory the passage listened to during Test 1.

⁷ Logical memory beginning "Fire at Boston."

⁸ Free association, number of words written in three minutes.

⁹ Number and quality of words written in Test 7.

¹⁰ Woodworth and Wells substitution test, No. 88042.

¹¹ Original test of author, to fill in missing lines in geometrical figures.

¹² Estimation of number of dots on card.

¹³ Easy opposites No. 77341—C-B.

three students represent, no doubt, the average ability of the entire student body and the results as shown in this curve indicate that their mental ability, as tested, approximates very nearly the curve for the surface of frequency and consequently represents the average distribution of mental activity. If this be so, and if the 183 students are a fair representation of the entire student body, it is evident that the grades as distributed for the shop work are based on a much lower standard than are the grades assigned for the theoretical subjects. Since the academic curve is skewed toward the failure point might it not be inferred that the standard is too high for the average student taking these courses?

A further detailed study leads to a consideration of the assignment for the separate courses. Plate II shows the distribution in per cents for the different courses. It does not however, indicate grades for the separate branches of the courses. Comparing the individual judgments for each subject with the combined judgment of the entire group, it will be noted that few if

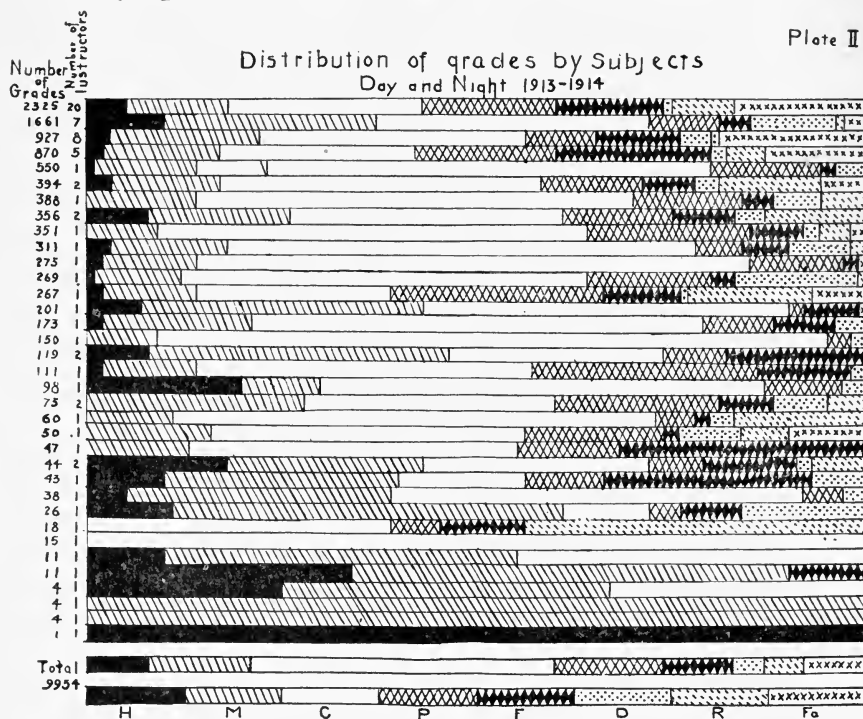
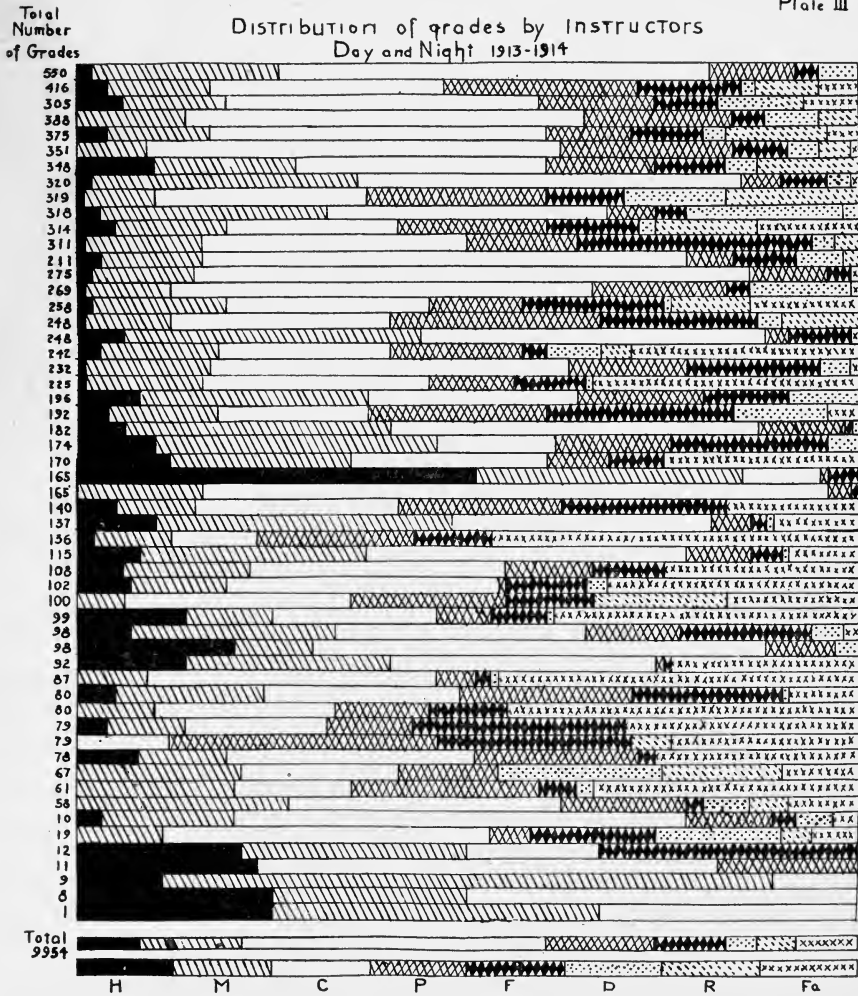


Plate III



any approximate the distribution of the entire faculty. In two very fundamental subjects forty per cent. of all grades given are below passing, while in another subject forty-five per cent. of all grades are below passing. In one academic subject thirty-five per cent. are below passing, while in one of the shop subjects only two per cent. fall below that grade. In another academic subject thirty-six per cent. are failures, while in another shop subject only three per cent. do unsatisfactory work.

Plate III shows the distribution of the grades by the individual instructors. Here the lack of conformity to a standard is especially marked. At the bottom of the plate the distribution of the 9954 grades represents the curve of distribution for the entire faculty. Of the 388 grades given by one instructor not one grade is accorded the value of "H," while another instructor in another subject gave the "H" grade to fifty-one per cent. of the 165 grades he assigned, and the "M" grade to thirty-four. In a different subject another instructor, with no doubt the same students, grants 351 grades, none of which is "H" and only nine per cent. are as high as "M." Of 136 grades given by another instructor fifty-seven per cent. are below passing, while of 165 grades granted by another instructor less than one per cent. is below passing, not one as high as "H" and eighty per cent. are given the grade "C." For 1914-15, this instructor assigned no "H" grades, ninety-three per cent. are "C's" and none is below passing except three per cent. of "D's."

Can such grading be justified on the assumption that the quality of work is different, that some instructors command ability, that the class is more interesting or better prepared, that the subject is more important or fundamental, that the instructor is superior? Or what can be truthfully assumed as the cause of this wide variation? Without some standard, foot-rule, or gauge one reason is just as plausible as another, and just as faulty as any other. The student who receives an "H" from one instructor cannot possibly receive that grade from another who holds his subject so important and his standard so high that no one can be considered perfect enough to merit the highest grade of the school—"Honor." Two of the instructors whose figures are quoted above did not give an "H" grade for the entire term 1912-13 and one of them none for the first term 1914-15. In other words, this instructor has not given an "H" grade in two and one-half years covered by this report. Is it possible that in two and one-half years not one student (who was graded by the large number of grades assigned by this instructor although many of them were honor students) could do work sufficiently well to merit an honor grade in this subject?

President Foster, of Reed College, who has made an exhaustive study of the distribution of grades at Harvard University and other institutions of learning has this to say: "Not only are there

extreme variations among different courses, but there are variations in the same courses from year to year that cannot be accounted for apparently by any of our scientific studies in the distribution of abilities among human beings. . . . From Maine to California the administration of college credits, though alike in no other particular, agree in this . . . that its basis is personal rather than scientific."¹⁴ The instructor who considers that out of 388 grades assigned there are fewer than one per cent. that are equal to the distinction of "H" has a very different conception of the requirements necessary to obtain that distinction from the instructor who places fifty-one per cent. of his 165 grades in the honor list. It is unjust to the student, to the instructor, or to the institution at large to distribute scholarships, class honors, or other meritorious "distinctions" on the basis of grades resulting from the personal opinions of instructors.

There is evident need of standardizing judgments in all school procedure and there must be definite scales, absolute units of value for school work, just as the mechanical field of endeavor has the foot-rule, galvanometer, thermometer, etc. Binet and Simon with their graded tests for general intelligence of children have led the way for the scientific study of mental attainments. The Russell Sage Foundation and school surveys have suggested means for measuring general school progress. Ability in school subjects is already being reduced to scientific measurement.¹⁵ Until a measuring scale is established for each subject a more scientific method of grading than the personal judgment standard is necessary in order that all concerned may receive equal and just recognition for school work.

There are several approaches to a scientific method of grading and the one herein described is so nearly scientific that, until the intellectual yard-stick is standardized which will be constant at all times and places and with all trained individuals, it may be used to good advantage. It is a system that was adopted to overcome the persistency of instructors to distribute their grades according to personal opinion. It was when a professor of the University of Missouri "flunked" his entire class, and the Board over-ruled him by passing the entire class, that some one of the faculty urged the adoption of a scientific system of grading.

¹⁴ W. T. FOSTER. *Administration of the College Curriculum*, pp. 262, 266.

¹⁵ DANIEL STARCH, *Educational Measurements*.

Since 1908 when the University of Missouri adopted a method and defined definitely the means of establishing various grades, many institutions have adopted similar plans which have for the most part satisfied the demands of the executives, the faculty, and the student body. The most recent adoption of a plan is by the George Washington University, and the following is taken from their announcement as published in the JOURNAL OF EDUCATIONAL PSYCHOLOGY.

The Committee on Standardizing Grades appointed in June submitted the following report March, 1914, on the following two problems: First, How can the amount of work for each unit of credit be approximately equalized in the various courses? Second, What common standard of grading can the various members of the faculty observe so that they will grade approximately the same standard?

From this report the following is quoted:

"In submitting principles and standards for the solution of these problems, the committee wishes, first of all, to be understood that it does not wish to dictate, or even to suggest, how any member of the faculty should do his work. It not only has no intention of curtailing the legitimate rights and freedom of any teacher, but it desires especially to emphasize that these rights and freedom are sacred; that they are an indispensable condition for the best type of university work. But in schools, colleges and universities the personal side is not the only side of teaching. There is present also a social side, which grows out of the fact that a school is in some fundamental aspects a social unit. The various members of the faculty are all working to contribute piecemeal to the same end. . . . Considered from the social standpoint, the college in common with other schools, performs two interrelated, and although distinguishable, fundamental functions. It (1) educates and (2) selects. . .

"The giving of grades to students is only one of a number of means that the school uses in discharging the selective function of education, but it is one of the most important. Like other educational functions it must be done carefully, intelligently and uniformly in order to avoid injustice to the student. The desideratum of uniformity requires not only that each teacher always uses approximately the same standard with all of his students, but that all teachers use the same standard with all of

the students. When this is not done the educational equilibrium of the school is disturbed and injustice is done to the earnest and conscientious student. The less serious the students are, the more they tend to gravitate toward teachers that give the highest grades, and the injustice that this tends to work upon the conscientious student when it comes to the awarding of honors and the recommending for positions is obvious. The giving of many high grades, furthermore, gives many students a false and exaggerated notion of their ability. The grade "A" should be reserved for the very exceptional ability which in the nature of the case is rare.

"The principles underlying a uniform standard of grading are found in the distribution of mental ability as revealed by psychological investigations. These investigations have shown, when sufficiently large numbers are considered, that ability in general or in any particular line is distributed in the form of a bell-shaped curve, technically known as the probability curve or the normal curve of frequency. Letting the base line represent the degrees of ability from the poorest to the best and the vertical lines the number of persons possessing each degree of ability, there is, at best, but a small number of students with excellent ability, a large number with good ability, a relatively larger number with medium or average ability, a smaller number with sub-medium but passing ability and a smaller number with distinctly unsatisfactory ability.

"There are, of course, no sharp dividing lines between these groups. The grade of A or excellent should be assigned to about 4 per cent. of the students, B or good to about 24 per cent., C or medium to about 44 per cent., D or sub-medium to about 24 per cent. and E or failure to about 4 per cent. It is quite likely that the percentage of failure in the lower classes may properly be somewhat higher than that in the upper, with corresponding changes in the other percentages, and failures may perhaps also properly be more frequent in professional schools than in liberal culture schools. Because of its immediate social responsibility, it is the duty of the professional school to apply the principle of selection rigidly."

THE EFFECT OF THIS REPORT

As stated in the letter of transmission it was thought that the instructors would recognize the value of a uniform distribution

and that they would endorse and encourage the adoption of some system by their own willingness to approximate a suggested standard. This assumption is not justified by the distribution of grades for the night or day students for the second semester. While there seems to be a tendency to approximate nearer the normal distribution when the curve for the entire distribution for the second semester is plotted; yet the variation of distribution of the day grades with that of the night grades by the individual instructors is marked and seems to indicate that no conscientious effort was made to systematize the distribution. In fairness to all it might be said that during the second semester at the time when this report was circulated and for the remainder of the term the Dean was on sabbatical leave, so that the report received no official sanction other than it was sent out from the Dean's office at his request. Many of the faculty, however, discussed the report with the author and all were familiar with the psychological testing of the first year students, and many availed themselves at faculty meetings and elsewhere of learning more definitely the type of mentality of their poorer students as determined by these tests.

It will be observed from the following figures that the combined distribution for the second semester gives "H" plus "M" an equal value with "P" plus "F" with fifty per cent. as the central distribution when grades "D," "R," and "Fa," representing conditions over which the instructor has little or no control, are left out of account.

	H	M	C	P	F	D	R	Fa	H	M	C	P	F
1st Sem.....	4	16	44	17	9	4	3	1	3	17	50	17	11
2d Sem.....	6	18	47	14	9	1	2	3	7	18	50	15	10

There has been a gradual shifting toward the upper end of the curve as indicated by the following tabulation which represents the distribution of day grades for both semesters of each year:

	H	M	C	P	F	D	R	Fa
1912-13.....	3	15	46	15	10	3	4	4
1913-14.....	3	17	45	15	10	3	5	2
1914-15.....	4	18	47	14	9	1	2	3

And while the grades for the second semester 1914-15 tend to show progress in this direction it can hardly be ascribed to the results of this report. Plate IV presents the distribution of grades for the first and second semesters, day courses for the

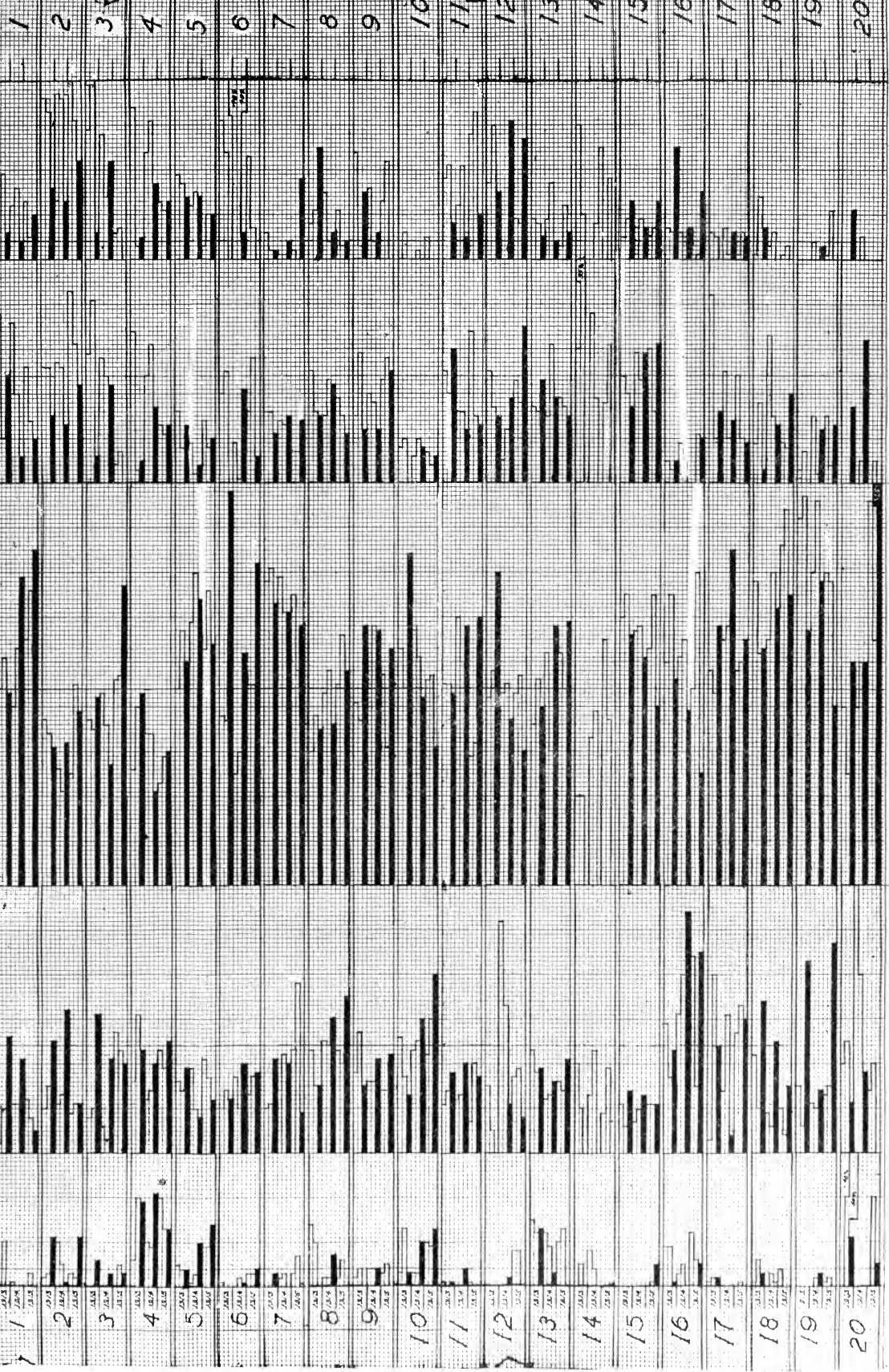
HONOR

MERIT

CREDIT

PASSED

FAILURE



years 1912-13, 1913-14, and 1914-15 and the total distribution for both semesters of the night courses for the years 1912-13 and 1913-14, but only the second semester for 1914-15. The grades for the second semester, night are given instead of the total distribution for the night courses for 1914-15 for the reason that it is desired to show a second attempt at grading after the report on the advisability of some uniform grading system was made known to these instructors. The distribution for the night grades is shown in black. Of the eighty-three instructors that assigned the 31,391 grades—the total number considered in this report—only twenty-six have been with the institution long enough to assign grades for each semester of the three years. Of these one taught only night courses, another only day courses. The marks of four others, whose grading shows no peculiarities compared with the others recorded in Plate IV, are omitted for the sake of brevity. In an institution where the faculty is constantly changing it is obvious that many difficulties arise in any attempt to enforce uniformity; but at the same time there is a greater need for uniformity in such an institution in order that the ever changing instructors may readily know the quality and the amount of work to be exacted. From a careful study of Plate IV, I am led to believe that there has been no conscious attempt made to assume a normal curve of distribution for the two final gradings after this report was made known. It is evident that the strong appeal made by the Committee of the George Washington University had little or no weight on the grading by the faculty of the Carnegie Institute of Technology. Personal opinion seems to be the only standard they were willing to use.

From the foregoing study the following points are summarized:

1. Grading for the vast majority of teachers is based on personal opinion.
2. Personal opinions are influenced more by temperamental attitude than by the nature and type of subject matter taught.
3. Elimination due to failure is unjust, especially when failure is determined by the teacher's personal opinion.
4. The granting of honors, etc., is debasing when the curve for graduation deviates so markedly from the distribution curve of all students as at Carnegie.

5. Night students ought to have a different standard from that of day students.
6. Shop instructors as a class are less exacting than academic instructors.
7. Instructors in shop subjects vary their grades as much as do academic instructors.
8. Distribution of ability as shown by grades assigned is not in conformity with ability as indicated by psychological tests.
9. Instructors are not willing to burden themselves with standardization of their grades so long as the institution is willing to accept haphazard personal judgments.
10. The distribution of grades by the entire faculty can hardly be considered a true curve for that institution since some instructors may distribute their grades so widely that they destroy the educational equilibrium of the school.
11. A curve of distribution can be based on the mental ability of the students as shown in some well devised psychological tests; or on a curve as established by a distribution of grades within that institution covering a number of years.
12. Such curves of distribution are fairer to the students and the institution than some arbitrary standard as suggested at Missouri, George Washington and other institutions which base their curve on the normal surface of frequency. If the entrance requirements have been selective of a group then the normal distribution curve is not an adequate distribution.
13. A curve based on psychological tests limits the standard of the institution to the type of general mental ability of the students. This may be very beneficial to the student but what would eventually be the standard of the institution?
14. A curve based on the former grades of an institution upholds the traditions of the institution but is not just in the long run to many of the students.
15. A curve which expresses the correlation of mental tests of the students within the institution with the distribution of grades as assigned by many instructors through many years ought to give a distribution which would maintain

the traditional standards of that institution and at the same time give the individual student full justice. Once this curve is established the entrance requirements can be measured by it in order to eliminate some of the wasteful teaching in the earlier years. "About one-third of all elimination is caused by the fact that the scholarship rating of the freshmen at the university is only one-third of the rating of the same student in the last year of high school, when based upon the actual amount of time spent in study. The serious break in a student's standing when he enters the university tends to discourage him and to drive him out of school. The university should raise its scholarship rating of freshmen students about 10 per cent., or one letter, according to the system of marking in use, and the high schools should lower that of their senior classes about the same amount. This would close the unnatural and harmful breach between them, and would reduce the large percentage of elimination."¹⁶

¹⁶ E. D. JENNINGS. *Elimination of Freshmen from the University of Texas*. JOURNAL OF EDUCATIONAL PSYCHOLOGY, April, 1915, p. 221.

THE MEASUREMENT OF ABILITY IN LATIN. PART II. SENTENCE TESTS.

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The measurement of ability to understand or translate Latin may be attempted in several ways. A passage of connected discourse may be selected, as Mr. H. A. Brown, of the Department of Public Instruction, Concord, New Hampshire, has done,¹ or an appropriate list of sentences may be constructed or selected. In either case the measurement may be in terms of speed or accuracy of translation. The passages or sentences may be used further as a basis for tests of knowledge of grammar. The results to be reported in this study are based on two sets of sentences, one of thirty sentences and the other of fourteen (reduced from fifteen through a typographical error in one of the sentences) and the measurement is in terms of accuracy of translation solely.

LATIN SENTENCE TESTS

One of the underlying purposes of the detailed study of vocabularies, which resulted in the list of 239 words in the Standard Vocabulary, was the use to which the list might be put in constructing sentences and testing ability in translation and knowledge of grammar. It was felt that to be most useful the sentences should not contain words that the pupil had not come in contact with and could not reasonably be expected to know. Hence, sentences were built up using no words not contained in the list of 239. From a considerable number of such sentences a selection of thirty sentences was made with the advice and counsel of Latin teachers. The design was to select a few sentences so easy that they would be gotten by a very considerable number of first year pupils and also a few sentences so difficult that they would be missed with considerable frequency by fourth year pupils. The intermediate sentences were graduated in difficulty as nearly as this could be done by the estimates of a few teachers. It was hoped that from this list when given to a large number of pupils in each year two sets might be secured, one of ten sentences grading up in difficulty by fairly uniform

¹ BROWN, H. A. In an unpublished study reported at the meeting of the A. A. A. S., New York, December, 1916.

steps, and another of ten sentences that would be approximately equal in difficulty and would show, moreover, progressive increase in difficulty from the first year to the fourth. This design has not as yet been fully realized. A much larger number of sentences must be constructed and tried out with pupils before it can be realized. In the meantime the results so far obtained are worth reporting.

The first list of thirty sentences was as follows:

LATIN SENTENCE TEST—A.

1. Puer bonus est.
2. Filius patris similis erit.
3. Illi homines duos amicos habebant.
4. Hi omnes magnae virtutis erant.
5. Haec urbs multo maior eo oppido erat.
6. Equites urbem hostium magna cum virtute oppugnaverant.
7. Nihil novi de bello audivi quod non in urbe fui.
8. Huic viro multi servi erunt.
9. Este fortes, milites, et tela longissime conicite.
10. Ille dux nomine sed non factis amicus erat.
11. Nuntius matri dixit filium noctu venturum esse.
12. Dic mihi quid tibi in animo sit.
13. Periculis multis in vita superatis mortem non timebit.
14. Navem post primam lucem non relinquebant, ne viderentur et audirentur.
15. Cum in urbem venissem et ibi de principis fortuna bona certior factus essem, domum ivi.
16. Castra consulum a nostris paucis diebus capiuntur.
17. Cum miles fortiter in bello pugnavisset ad domum profectus est.
18. Rogas cur proelium nunc relinquere velim.
19. Cur te in his periculis non defendisti?
20. Auxilium mittet ne hostes urbem capiant.
21. In eo loco ad multam noctem se defenderunt.
22. Nonne vereris ne omnem fortunam amittas?
23. Velim fratrem tuum roges, ne nos relinquat.
24. Scit te saepe nomen imperatoris huius audivisse.
25. Centum naves corpora armaque quae post proelium in agris relictæ erant contulerunt.
26. Nihil habeo quod populo dem.
27. Alii alia dixerunt sed omnes eum magna virtute esse sciebant.
28. Dicere non possum quam diu pater meus in eo loco fuerit.
29. Si imperator esses, daresne proeli committendi signum?
30. Qui bonum cum potest non defendat non laudandus est.

This list contained too few easy sentences for first year pupils. In fact, an astonishingly large percentage of pupils tested in June were unable to translate more than the first sentence. The first sentence was correctly translated by 97 per cent. of first year pupils, the second by 52 per cent. and the third by 50 per cent. The remainder range below 50 per cent. correct. Even for third and fourth year pupils the percentages for all but the first two sentences are low.

A second list of fourteen easier sentences was prepared as follows:

LATIN SENTENCE TEST—B

1. Homo malus est.
2. Navis parva est.
3. Via erat longa et lata.
4. Sunt viri fortes.
5. Tuum fratrem non video.
6. Amicus pueri nuntius erat.
7. Ubi sunt copiae hostium?
8. Mors finis esse videtur.
9. Pater vocat filium.
10. Dux dicitur pervenisse.
11. Filia parva in periculo est.
12. Servum misit quem secum habebat.
13. Id dictu quam factu facilius est.
14. Dixit se dare quod peterent.

Even this list as the tables below indicate does not contain enough sentences sufficiently easy to supply the desired steps at the lower end of the scale.

Test A was given in June, 1916, and 1917, in seventeen schools to 262 first year, 244 second year, 94 third year and 74 first year pupils. Test B was given in June, 1917, in sixteen schools to 412 first year, 261 second year, 105 third year and 78 fourth year pupils. In checking the papers which were returned to me no attempt was made to devise a plan to score sentences as partly correct. The sentences were scored either as right or wrong. The results for Test A appear in Table I, giving the median number correct, the average number correct, and the number of pupils. Table II sets forth the same facts for Test B. The letters designating the schools are the same as in the Vocabulary Test.

The application of standard tests and scales in elementary subjects has shown astonishing variations in schools and pupils and great overlapping of abilities from year to year. The same striking variability is shown in the relatively more highly selected secondary school pupils in Latin. An inspection of the tables shows some surprising facts. The first year pupils in School O do better in Test A than the third and fourth year pupils in three other schools and the second year pupils in seven. In Test B the first year pupils of the same school surpass the third and fourth year pupils in all but two schools. The range of the medians in Test A for the different schools from 1 to 11 correct in the first year, 4 to 19 in the second, 6.5 to 24 in the third and 3 to 25 in the fourth, shows a surprising state of affairs. As is shown for other purposes in Table V below the overlapping from year to year is marked. In Test B forty per cent. of first

TABLE I.

Test A

School	Medians				Averages				No. of Pupils			
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
B.	6	11	20.5	23	6.0	10.2	19.3	25.4	55	41	8	8
C.	4	7	16	12.5	4.1	7.5	16.9	12.2	46	28	14	6
E.	2	4	....	3	2.3	5.2	....	2.9	20	35	..	7
F.	2	5	11.5	....	2.1	5.6	11.0	....	9	9	6	..
G. ....	..	12	....	....	....	12.7	....	....	..	25	..	1
H.	1	6	7.5	9	1.6	7.2	8.7	9.3	5	5	6	3
I.	5	15	....	20.5	6.1	12.2	....	21.0	11	4	1	4
J.	3	11.5	15	20	3.4	11.2	15.0	21.2	23	10	2	5
K.	2	8	20	22	2.3	8.5	20.8	21.0	21	19	5	8
L.	1	4	9	12.5	2.1	4.4	10.0	12.5	9	12	5	4
M.	3	4	6.5	19.5	4.0	6.5	11.4	19.4	13	10	14	8
N.	5	4.5	13.5	19	6.8	7.9	12.4	19.0	24	18	12	7
O.	11	19	24	25	11.9	18.1	23.8	26.2	17	18	9	9
P.	6	12.5	21	21	5.9	13.2	18.3	21.0	9	4	3	2
Q. ....	..	..	20	....	....	....	18.8	....	..	..	9	..
R. ....	..	11	....	....	....	14.2	....	....	..	6	..	..
S. ....	..	....	....	10.5	....	....	....	10.5	..	..	..	2
	4	7	16	20	4.9	9.3	15.3	18.2	262	244	94	74

TABLE II.

Test B

School	Medians				Averages				No. of Pupils			
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
B.	9.5	11	12	12	9.9	10.4	10.9	11.7	54	51	20	12
C.	6	9	11	12	6.0	9.0	10.8	12.3	65	32	10	8
D.	6	7	11	12	5.7	7.5	10.5	11.7	42	21	11	12
E.	6	5	9	..	6.1	5.8	9.2	....	37	24	11	1
G.	8	9.5	..	..	8.8	9.8	....	....	50	24	..	1
H.	3	6	6	10	3.0	6.0	6.8	10.0	5	5	6	3
I.	8	8.5	..	11.5	7.6	8.2	....	10.7	11	4	1	4
J.	5	8.5	12.5	13	5.8	8.4	12.5	12.8	23	10	2	5
M.	4	6	9	12	4.6	5.9	8.8	11.5	13	10	14	8
N.	8	6	9	12	8.0	6.3	9.2	10.9	25	19	12	7
O.	12.5	14	14	13	11.8	13.0	13.4	13.3	18	18	9	9
P.	8	11.5	11	11	7.4	11.5	11.0	11.0	9	4	3	2
Q.	8	....	....	....	8.3	....	....	....	11	..	..	..
R. ....	..	11	....	....	....	9.4	....	....	..	5	..	..
S.	11	....	....	11.5	10.8	....	....	11.5	10	..	..	2
T.	11	9	12	11	10.4	8.5	11.3	10.5	39	34	6	4
	8	9	11	12	7.8	8.8	10.2	11.6	412	261	105	78

year pupils reach or exceed the median ability of the second year, twenty-two per cent. that of the third year and fifteen per cent. that of the fourth year. On the other hand, there are in the same test thirty-five per cent. of second year pupils and seventeen per cent. of third year pupils who do not reach the median ability of the first year. The range of variation by pupils in Test A is very great, from none correct (six pupils) to twenty-four sentences correct for the first year, from one (eight pupils) to twenty-seven (three pupils) for the second year, from one (two pupils) to twenty-nine for the third year, and from one to thirty in the fourth year. In Test B the ranges are for the first year from none correct (six pupils) to fourteen correct (sixteen pupils) for the second year from one to fourteen, for the third year from three to fourteen and for the fourth year from five to fourteen. Figures 1 and 2 show graphically the distribution and overlapping for each year in the two tests.

ARRANGEMENT OF SENTENCES IN ORDER OF DIFFICULTY AND DETERMINATION OF SCALE VALUES

The averages and medians in Tables I and II are given in terms of the number correct, regardless of the varying difficulty or the weight to be assigned to each sentence. To determine this weight the same method substantially as was employed in scaling the words in the Vocabulary Test was used with the sentences. The same two assumptions were made: viz., that ability to translate Latin is distributed normally, and that the real variability for each year is approximately the same. The per cent. of times each sentence was translated correctly being known, its position on the base line of the normal surface of frequency in terms of P. E. deviations above or below the median was determined. In order to obviate the disadvantages of working with minus and plus values -3.8 P.E., was, as with the words, taken as a point of reference or zero point. Tables III and IV give the percents correct for each sentence, for each year, and the corresponding year scale values obtained by subtracting the P. E. equivalents of the percents correct from -3.8 P.E., as indicated above.

The last column headed General Scale Values gives the position of each sentence for the four years combined when referred, first, to the median of the first year and then to eliminate minus

Fig. II.
Test B.

Showing Overlapping of Abilities in Successive Years.

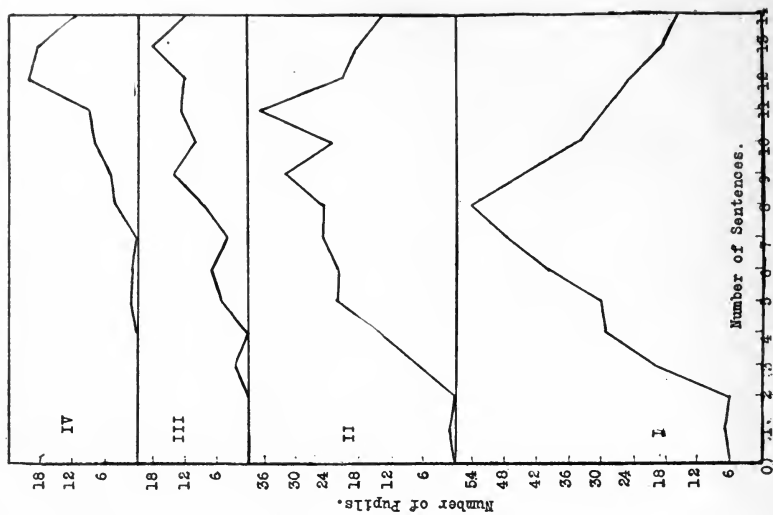


Fig. I
Test A.

Showing Overlapping of Abilities in Successive Years

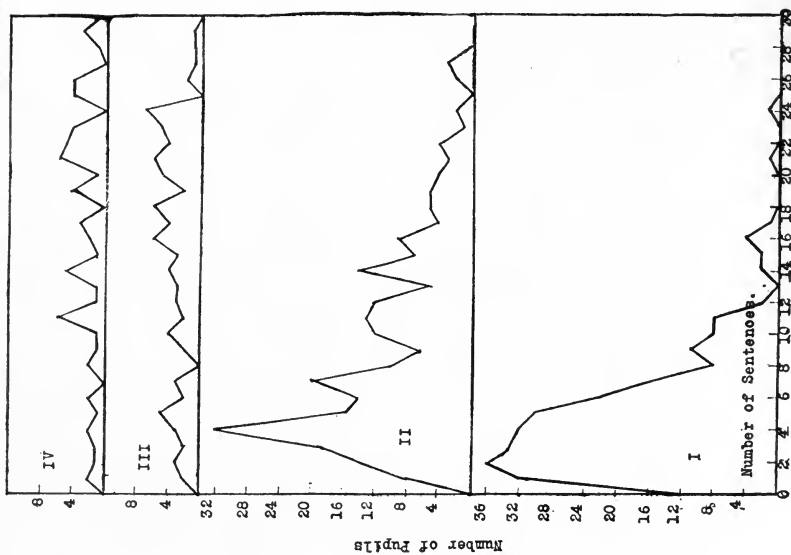


TABLE III.
Sentence Test A

	Percents Correct				Year Scale Values				General Scale Values
	I.	II.	III.	IV.	I.	II.	III.	IV.	
1.	97.0	97.6	100.0	100.0	1.0	.9	0	0	.0
2.	52.3	57.0	75.5	79.6	3.7	3.5	2.8	2.6	2.7
3.	50.0	48.4	57.4	58.1	3.8	3.9	3.5	3.5	3.2
4.	28.6	70.1	73.4	74.3	4.6	3.0	2.9	2.8	2.9
5.	32.9	45.5	55.3	57.7	4.5	4.0	3.6	3.5	3.4
6.	35.9	61.9	60.6	66.2	4.3	3.4	3.4	3.2	3.1
7.	25.6	78.3	65.9	66.2	4.8	2.6	3.2	3.2	3.0
8.	25.6	41.0	42.6	40.5	4.8	4.1	4.1	4.2	3.8
9.	10.3	32.4	50.0	64.8	5.7	4.9	3.8	3.2	3.9
10.	8.8	26.2	54.3	70.2	5.8	4.7	3.6	3.0	3.8
11.	14.5	36.9	51.1	61.7	5.4	4.3	3.8	3.4	3.7
12.	10.3	25.0	76.6	83.7	5.7	4.8	2.7	2.3	3.4
13.	7.6	25.4	51.1	66.2	5.9	4.8	3.8	3.2	3.9
14.	3.1	29.5	52.1	63.5	6.6	4.6	3.7	3.3	4.1
15.	3.8	29.1	46.8	63.5	6.4	4.6	3.9	3.3	4.1
16.	11.1	12.3	28.7	40.5	5.6	5.5	4.6	4.2	4.5
17.	14.5	50.0	67.0	67.5	5.4	3.8	3.1	3.1	3.4
18.	2.3	18.4	54.3	74.5	6.8	5.2	3.6	2.8	4.1
19.	12.2	20.1	41.5	52.7	5.5	5.0	4.1	3.7	4.1
20.	18.7	16.4	38.3	50.0	5.1	5.3	4.2	3.8	4.1
21.	3.4	36.9	38.3	48.6	6.5	4.3	4.2	3.9	4.2
22.	1.9	15.6	55.3	51.3	6.9	5.3	3.6	3.8	4.4
23.	1.1	15.6	42.6	64.8	7.2	5.3	4.1	3.2	4.6
24.	5.0	13.9	46.8	58.1	6.2	5.4	3.9	3.5	4.3
25.	2.7	11.1	26.6	41.9	6.7	5.6	4.7	4.1	4.8
26.	1.9	11.1	56.4	55.4	6.9	5.6	3.6	3.6	4.5
27.	.4	12.7	27.7	36.5	7.7	5.5	4.7	4.3	5.1
28.	5.0	10.7	37.2	55.4	6.2	5.6	4.3	3.6	4.5
29.	1.5	15.6	28.7	31.1	7.0	5.3	4.6	5.0	5.0
30.	.4	4.5	24.5	72.9	7.7	6.3	4.8	2.9	5.0
	170.4				137.1	110.9	100.2	115.6	

TABLE IV.
Sentence Test B

	Percents Correct				Year Scale Values				General Scale Values
	I.	II.	III.	IV.	I.	II.	III.	IV.	
1.	90.6	93.7	94.2	89.7	1.8	1.5	1.5	1.9	.5
2.	88.5	93.7	89.5	94.7	2.0	1.5	2.0	1.4	.6
3.	78.7	82.0	76.2	85.9	2.6	2.4	2.8	2.2	1.4
4.	78.5	85.5	80.0	93.6	2.6	2.2	2.6	1.6	1.1
5.	57.1	61.1	83.8	93.6	3.5	3.4	2.3	1.6	1.6
6.	62.7	49.5	65.7	71.8	3.3	3.8	3.2	2.9	2.2
7.	74.8	90.6	87.6	94.7	2.8	1.8	2.1	1.4	.9
8.	25.8	28.6	71.4	78.2	4.8	4.6	3.0	2.7	2.6
9.	64.4	60.8	72.4	84.6	3.3	3.4	2.9	2.3	1.8
10.	22.1	29.8	52.4	60.3	4.9	4.6	3.7	3.4	3.0
11.	63.7	65.0	58.1	70.5	3.2	3.2	3.5	3.0	2.1
12.	29.6	61.9	78.1	91.0	4.6	3.4	2.7	1.8	2.0
13.	30.9	48.4	57.1	80.8	4.5	3.9	3.5	2.5	2.5
14.	13.9	43.0	58.1	74.4	5.4	4.1	3.5	2.8	2.8
	49.3				43.8	39.3	31.5	25.1	

and plus signs to the easiest sentence; *viz.*, the first sentence in Test A. In order to determine the average position of each sentence when referred to the first year median the size of the intervals between the medians of the different years had to be determined. Tables V and VI show the number and percents of pupils in each year who reach or exceed the median score in each of the other three years and the P.E. equivalents of the percentages (Tables V and VI). As in the case of the words, six direct and derived P.E. values expressing the intervals between each year were averaged to determine the most likely distance at which the medians of the second, third and fourth years lies above the first year median. These distances are as follows:

	M I-II	M I-III	M I-IV
Test A.....	1.151 P.E.	2.490 P.E.	3.011 P.E.
Test B.....	.479 P.E.	1.327 P.E.	2.127 P.E.

TABLE V.

Test A

Number and Percent in Each Year Reaching or Exceeding the Median of Every Other Year and the P. E. Equivalents

	I.	II.	III.	IV.
I. No.....	64	7	2	
Percent.....	24.4	2.7	0.8	
P.E.....	+1.028	+2.857	+3.571	
II. No.....	203	42	19	
Percent.....	83.2	17.2	7.8	
P.E.....	-1.427	+1.403	+2.103	
III. No.....	87	77	32	
Percent.....	92.6	81.9	34.0	
P.E.....	-2.145	-1.351	+ .612	
IV. No.....	70	65	47	
Percent.....	93.2	87.8	63.5	
P.E.....	-2.211	-1.728	- .512	

The general scale value was obtained by adding to the P.E. values of the sentences for the second, third and fourth years the intervals between the medians of these years and the first year. The average of the four values for each sentence thus obtained gives its position for the four year combined. The average position of the first sentence in Test A is -1.667 P.E. Taking this position as a point of reference or zero point to eliminate minus and plus signs, the general scale values indicate the distances at which each of the sentences lies above this point in terms of units of P.E. Sentences such as 18, 19, and 20, in Test A have

TABLE VI.

Test B

Number and Percent in Each Year Reaching or Exceeding the Median of Every Other Year and the P. E. Equivalents

	I.	II.	III.	IV.
I. No.....	167	89	60	
Percent.....	40.5	21.6	14.6	
P.E.....	+ .357	+1.165	+1.563	
II. No.....	170	90	53	
Percent.....	65.1	34.5	20.3	
P.E.....	— .575	+ .592	+1.232	
III. No.....	87	79	42	
Percent.....	82.9	76.2	40	
P.E.....	—1.409	—1.057	+ .376	
IV. No.....	76	72	59	
Percent.....	97.4	92.3	75.6	
P. E.....	—2.881	—2.114	—1.028	

the same position on the scale, 4.1 or, in other words, are of the same degree of difficulty. Again the difference between sentences 2 and 5 is equal to the difference between sentence 15 and 16.

The sentences may be used practically in a variety of ways. Either or both of the sets may be used as they stand and comparisons may be made with performances in typical schools. The weights or scale values to be given each sentence either for each year singly or for the four years combined are known. Thus, if Test B is used as it stands, for correctly translating the entire set 25.1 points would be the perfect score toward which for each sentence correctly translated the pupil would receive the points indicated in the general scale. If comparisons are to be limited to a single year the total of the scale values for that year and the values for each sentence can be used in the same way. The scores can readily be translated into percentages to conform to the usual methods of rating in schools if this is preferred. Any combination of sentences may be made at the discretion of the teacher and the scores used in the same way. A little calculation from Tables III and IV will give the scores obtained with these sentences in the schools tested in this study.

Two arrangements of ten sentences each of equal difficulty and grading up by fairly uniform steps are available by selection from the two lists. These arrangements with the scale values are as follows:

LATIN SENTENCE TEST I.

1. Ubi sunt copiae hostium?	1.0
2. Via erat longa et lata.	1.4
3. Pater vocat filium.	1.8
4. Amicus pueri nuntius erat.	2.2
5. Mors finis esse videtur.	2.6
6. Nihil novi de bello audiui quod non in urbe fui.	3.0
7. Dic mihi quid tibi in animo sit.	3.4
8. Ille dux nomine sed non factis amicus erat.	3.8
9. In eo loco ad multam noctem se defenderunt.	4.2
10. Velim fratrem tuum roges, ne nos relinquat.	4.6

28.0

LATIN SENTENCE TEST II.

1. Navis parva est.	.6
2. Sunt viri fortes.	1.1
3. Tuum fratrem non video.	1.6
4. Filia parva in periculo est.	2.1
5. Id dictu quam factu facilius est.	2.5
6. Equites urbem hostium magna cum virtute oppugnaverant.	3.1
7. Nuntius matri dixit filium noctu venturum esse.	3.7
8. Navem post primam lucem non relinquebant, ne viderentur et audirentur.	4.1
9. Nihil habeo quod populo dem.	4.5
10. Alii alia dixerunt sed omnes eum magna virtute esse sciebant.	5.1

28.4

When the tests are given the results may be scored in several ways. The score may be indicated simply by the number of sentences or steps passed. Thus if a pupil translates correctly the first six sentences his score would be six. If he misses the seventh but gets the eighth his score would be seven. He is credited with the eighth but penalized for missing the seventh.

A better method of scoring is to give for each sentence correctly translated its scale value and his score would then be the sum of these values. If the pupil translates the first six sentences in Test I correctly his score would be 12.0 with a perfect score 28.0. This can of course be expressed in percentages if preferred. Average scores by this method for the two tests based on the results indicated in the Tables would be as follows:

TEST I.

Year	I.	II.	III.	IV.
Percent correct.....	35.6	49.3	65.1	74.9
Score.....	10.0	13.8	18.2	21.0

TEST II.

Percent correct.....	37.5	50.6	61.6	71.7
Score.....	10.6	14.4	17.5	20.4

The selection of a list of ten sentences all equal in difficulty would be very useful for testing purposes. The number of sen-

tences studied is not sufficiently large to furnish such a list. However, the following ten sentences not mentioned in the above twenty do not differ very greatly:

LATIN SENTENCE TEST III.

1. Huic viro multi servi erunt.	3.8
2. Este fortes, milites, et tela longissime conicite.	3.9
3. Periculis multis in vita superatis mortem non timebit.	3.9
4. Cum in urbem venissem et ibi de principis fortuna bona certior factus essem, domum ivi.	4.1
5. Rogas cur proelium nunc relinquere velim.	4.1
6. Cur te in his periculis non defendisti?	4.1
7. Auxilium mittet ne hostes urbem capiant.	4.1
8. Scit te saepe nomen imperatoris huius audivisse.	4.3
9. Nonne vereris ne omnem fortunam amittas?	4.4
10. Dicere non possum quam diu pater meus in eo loco fuerit.	4.5

Scores in terms of the number correct and ignoring the small differences in difficulty between the sentences would be as follows:

TEST III.

	I.	II.	III.	IV.
No. correct.....	.9	2.2	4.6	5.8

This list is too difficult to be very satisfactory and will not be as useful as Tests I and II.

In an ideal scale of the type represented by Tests I and II the sentences should grade up by fairly uniform steps. Thus the fifth sentence in Test II gives the following percentages correct for each of the four years: 30.9, 48.4, 57.1, 80.8. It is a very satisfactory sentence. On the other hand the sixth sentence gives the following percentages: 35.9, 61.9, 60.6, 66.2. It shows an inversion in the third year and the graduation is imperfect. It will require experimentation with several hundred sentences to arrive at a genuinely satisfactory scale. Moreover, it is desirable to secure various alternative lists as a few hours coaching on the tests would naturally vitiate their value. My purpose is to accumulate in time results from a large number of sentences built up from the 239 standard words. In the meantime these sentences and tests should be useful for teachers and students of education.

A REPORT ON THE USE OF THE KANSAS SILENT READING TESTS WITH OVER ONE HUNDRED THOUSAND CHILDREN

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This report on silent reading is based upon the use of the Kansas Silent Reading Tests (devised by F. J. Kelly) during the years 1915-'16 and 1916-'17. Within this time more than 700,000 copies of these tests have been distributed by the Bureau of Educational Measurements and Standards. Out of the total number of tests distributed, reports have been received from more than 100,000 pupils in 160 cities. These tests are so well known that they will be described only briefly here. An account of their derivation may be found in the JOURNAL OF EDUCATIONAL PSYCHOLOGY for February, 1916. Sample copies of these tests may be obtained from the Bureau of Educational Measurements and Standards, Emporia, Kans.

Three tests make up the series. Test I is for grades 3, 4, 5; Test II, for grades 6, 7, 8; and Test III, for grades 9, 10, 11, 12. Each tests consists of sixteen exercises. The exercise requires the pupil to make a definite response. The tests may be said to be objective in the sense that there is little opportunity for differences of opinion in marking the test papers. The nature of the exercises is illustrated by the following selected from Test II:

No. 1.

Value The air near the ceiling of a room is warm, while that on the floor is
1.0 cold. Two boys are in the room, James on the floor and Harry on a
 box eight feet high. Which boy has the warmer place?

No. 3.

Value We can see through glass, so we call it transparent. We can not see
1.6 through iron, so we call it opaque. Is black ink opaque, or is it trans-
 parent?

No. 7.

Value A boy goes to school in the morning, goes home at noon for lunch,
2.4 returns to school at 1 o'clock and returns home at 4 o'clock. How
 many times does he travel between home and school that day?

No. 11.

Value 4.0 "The curfew tolls the knell of parting day,
 The lowing herds wind slowly o'er the lea,
 The ploughman homeward plods his weary way,
 And leaves the world to darkness and to me."—(*Gray.*)
 Study the above quotation carefully. The author lets us know his feeling about the coming of night. If you think his feeling is one of fear and dread, underscore curfew. If his feeling is one of peace and gladness, underscore ploughman.

It will be noticed that each exercise has been evaluated in terms of a common unit. A pupil's score is the sum of the values of the exercises which the pupil does correctly in five minutes. In Table I there are given the median scores for the first-, second-, and third-class cities of Kansas, for Iowa, and for the other states by groups. In addition to the median scores there is given the number of pupils taking the tests in each group of states. The total number of scores included in this table is more than 100,000. In most of the cities all the pupils enrolled in the several grades were tested, or in the case of some of the larger cities the tests were given to a sufficient number of pupils to make certain the representative character of the results. In the case of a very few cities the tests were secured by individual teachers and given only to the pupils in one or two buildings.

Strictly speaking a score is not a measure of a pupil's ability. A score represents only a pupil's performance at a given time under given conditions. Any change of conditions will produce corresponding changes in his performance. Conditions include such things as the time allowance, physical conditions, temperature, humidity, lighting, and the emotional status of the pupil. In general it is probable that standard conditions have prevailed in the giving of the tests, but in the case of particular pupils it no doubt has happened that conditions were not standard. Possibly the pupil's own physical condition was not standard, or his pencil point may have broken, or his emotional status may have not been standard, or he may not have possessed at this particular time his normal mental alertness.

The presence of many of the standard conditions depends upon the examiner, and it may have happened that certain examiners produced conditions which materially affect the scores of the pupils whom they tested. They may have done this by urging the pupils to work rapidly in giving the directions for the test or by suggesting to the pupils that they were in competition with pupils in other schools. It may be that some examiners, because

they felt rather excited themselves, made the pupils unduly excited.

Performance, therefore, is subject to wide variations. Ability can not be measured. It can be inferred accurately from performance only when we know of the conditions attending the performance. We may assume that standard conditions prevailed, but in making inferences regarding the ability of particular pupils or particular classes, the fact of this assumption must not be forgotten.

A few of the very high medians may be due to the fact that the pupils tested were not representative of the schools. In some cases it appears probable that the high median is due to the fact that they are based upon scores from only a small number of pupils who are clearly not representative of their group. For example, this is doubtless true of the tenth-grade median for Kansas second-class cities and of the twelfth-grade median of the southern states. The total medians and the medians for Kansas and Iowa are represented graphically in Fig. 1. The total medians are represented by the heavy solid line, the Kansas medians by the light solid line, and the Iowa medians by the broken line. In studying this figure it should be remembered that Test I was used for grades 3, 4, 5, and Test II for grades 6, 7, 8. This change in tests probably accounts for the apparent lack of increase in ability to read silently from grade 5 to grade 6. A similar change of tests occurs between the eighth and ninth grade, but apparently this change did not affect the scores in the same way as the change of tests at the sixth grade.

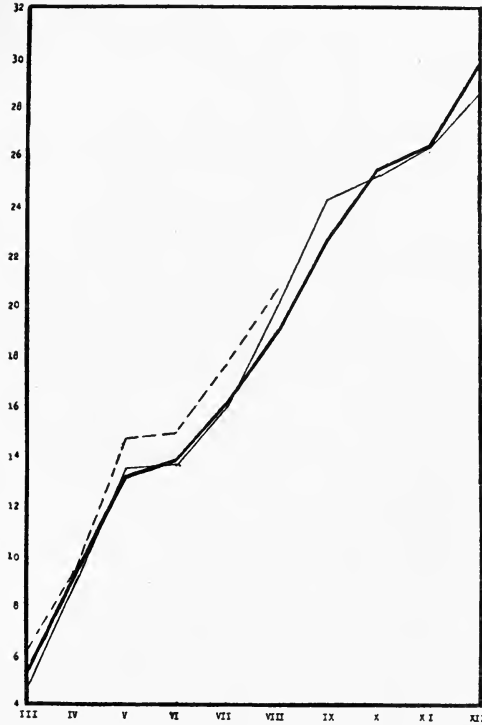
The median scores for Kansas agree very closely with the total median scores. It is interesting to note that the median scores for Iowa are conspicuously above the total medians and the Kansas medians. A similar condition exists in the case of arithmetic.¹ Apparently the public schools of Iowa are able to do superior work in these subjects.

The reports from the several states have been grouped into five sections and the median scores for each group given in Table I. The median scores for the several groups of states agree rather closely, on the whole, where the number of pupils tested is one hundred or more. There are, however, some slight variations which are rather interesting. The median scores for the

¹ See Second and Third Annual Report of the Bureau of Educational Measurements and Standards, Kansas State Normal.

Figure 1

Showing the median scores for Kansas Silent Reading Tests. Medians based on over 100,000 scores. Kansas———, Iowa-----, total———.



South Atlantic states are, on the whole, the lowest. It was hoped that we would secure some additional reports, since the medians given here are based almost entirely upon reports from one large southern city. This fact may be sufficient to account for the low medians.

The medians for the Western states are among the highest. Just why these medians should be so much higher than the medians from the other sections of the country is not clear. It may be that the medians are not based upon reports from representative cities. Another possible reason is that in other sections of the country children of foreign parentage are more of a factor. In cities where there are a considerable number of children of foreign parentage it has been found that in general lower scores are made.

Ability to read silently involves two factors: First, rate of silent reading; and second, understanding or comprehension of

TABLE I.

Kansas Silent Reading Test, Median Scores Based on Over 100,000 Scores

	III.		IV.		V.		VI.		VII.	
	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils
Kansas:										
First-class cities...	4.5	1,873	8.8	2,018	13.1	1,819	13.8	1,590	16.1	1,546
Second-class cities..	5.9	966	9.7	1,067	14.3	994	14.3	1,024	17.3	613
Third-class cities...	4.6	373	8.2	524	11.8	471	12.5	518	14.0	352
Kansas total...	4.9	3,212	9.0	3,609	13.4	3,284	13.7	3,132	16.1	2,511
Iowa.....	6.2	2,371	9.5	2,940	14.6	2,695	14.8	2,597	17.7	2,143
South Atlantic states.	6.0	398	9.2	350	13.9	332	11.6	326	14.5	179
North Atlantic states.	5.3	5,780	9.6	3,658	12.9	4,020	13.6	3,168	16.7	3,183
South Central states.	4.7	686	8.4	723	12.3	702	11.8	602	15.4	498
North Central states.	5.1	6,358	9.3	6,453	13.1	6,540	13.6	5,762	16.2	5,374
Western states.....	6.1	2,282	10.6	2,509	14.4	2,643	15.0	2,673	18.0	2,508
Grand total.....	5.3	21,087	9.5	20,242	13.2	20,216	13.9	18,260	16.2	16,396

TABLE I.—Concluded

	VIII.		IX.		X.		XI.		XII.	
	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils	M.	Pupils
Kansas:										
First-class cities...	19.7	1,334	25.3	317	27.1	199	27.8	201	29.7	115
Second-class cities.	20.6	596	33.7	72	33.6	32	.....	.....	.....	.....
Third-class cities...	20.6	560	20.6	346	23.7	289	26.0	262	27.6	250
Kansas total.....	20.1	2,490	24.3	735	25.2	520	26.5	463	28.4	365
Iowa.....	20.6	1,819	.....	.....	.....	.....	.....	.....	.....	.....
South Atlantic states.	15.8	179	21.8	110	20.7	96	25.0	78	39.3	8
North Atlantic states.	17.8	1,948	24.8	345	28.9	122	22.8	53	27.0	47
South Central states.	19.2	350	22.4	121	24.5	133	25.0	68	29.2	74
North Central states.	18.2	5,060	21.5	1,356	25.7	1,045	26.5	736	31.8	612
Western states.....	20.6	2,075	23.5	232	26.0	234	26.4	186	31.4	115
Grand total.....	19.2	13,921	22.9	2,899	25.6	2,150	26.5	1,584	29.7	1,221

the material read. Sometimes this second factor is called quality of reading. In the case of the Kansas Silent Reading Tests these two factors are combined in a single score. The values assigned to the exercises which make up these tests were made proportional to the average length of time required to do the several exercises correctly. Since the two factors are combined in this way, we have no expression of the relative weight of each in the value of the exercises.

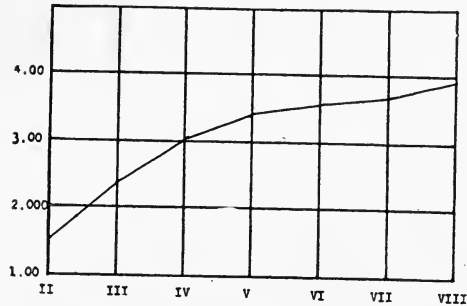


Figure 2.
Showing progress of pupils in rote and silent reading as measured by the Gray Silent Reading Tests.

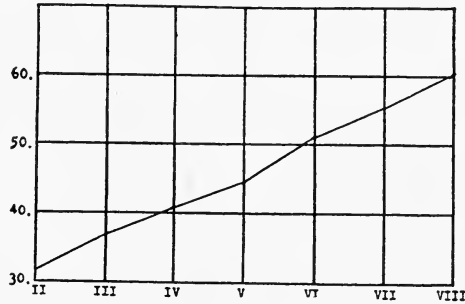


Figure 3.
Progress of pupils in quality of silent reading as measured by the Gray Silent Reading Tests.

In Figs. 2 and 3 are shown the curves of progress for rate of silent reading and for quality of silent reading as determined by means of the Gray Silent Reading Tests.¹ The curve of progress for the rate of silent reading, Fig. 2 rises rapidly for the earlier grades and less rapidly in the upper grades, with the partial exception of the eighth grade. This means that the pupil in learning to read increases his rate of silent reading most rapidly in grades 2, 3, and 4. In the following grades his increase is very slight. When we study the curve of progress for quality of silent reading in Fig. 3 we find that the pupil continues to increase the quality of his silent reading at about the same rate throughout the several grades represented. Apparently the pupils' improvement in silent reading in the upper grades is in quality rather

¹ GRAY, WILLIAM S., *Studies of Elementary School Reading from Standardized Tests*, pp. 53-54. Supplementary Educational Monographs, University of Chicago, No. 1, 1917.

than rate. This increase in quality in the case of the Gray Silent Reading Tests means that the pupils is able to comprehend more difficult passages as well as to comprehend them more fully.

If we compare these two curves of progress with the curve of progress for the Kansas Silent Reading Tests shown in Fig. 1, we find the curves of progress for the Kansas Silent Reading Tests corresponds closely in shape to the curve of progress for quality of silent reading. This fact suggests that the scores made on the Kansas Silent Reading Tests are measures of the quality of silent reading rather than the rate of silent reading. No final conclusion should be drawn from the data presented in these three figures because the tests were not applied to the same group of pupils, but since both of the tests have been used rather widely, particularly the Kansas Silent Reading Tests, it probably is safe to think of the Kansas Silent Reading Tests as placing more emphasis upon comprehension or quality of silent reading than upon rate of silent reading.

It has frequently been asked, What is the effect upon a pupil's score of his acquaintance with the test? No definite study has been made to determine the answer to this question. It has been a rather important question because only one form of the Kansas Silent Reading Tests was available, and if a superintendent wished to know what improvement had been made in silent reading he was forced to repeat the same test.

It is probable that several factors will affect the second set of scores. If the tests have been made the subject of a study by the pupils, without doubt the scores will be much higher. Even if the pupils have been drilled upon the type of reading which these tests call for, doubtless the second set of scores will be much higher than the first set.

In Table II there are given two sets of scores for several cities in which the tests were given the second time and both sets of scores reported to the Bureau of Educational Measurements and Standards. A study of this table will show that in certain cases the scores of the second set are conspicuously higher than those of the first set. In certain other cases they are lower. The facts of this table suggest that the pupil's acquaintance with the tests, through merely having taken it, does not greatly influence a second score. Otherwise it would be difficult to understand how a second set of scores might be lower than the first set.

TABLE II.
Cities Giving the Tests Twice

City	Date	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
LXXV.	11-15	3.1	7.3	12.4	12.1	13.5	18.2	22.7	25.1	20.0	30.0
LXXV.	4-16	7.3	11.9	16.0	18.8	20.9	27.0	30.0	28.3	34.8	29.5
XXVII.	4-16	3.5	7.4	12.9	11.7	16.3	18.4	....	....	....	....
XXVII.	3-17	4.5	13.8	14.3	13.2	19.5	21.6	....	....	....	....
CLXVIII.	10-16	....	5.0	9.4	8.6	14.4	13.0	....	....	....	....
CLXVIII.	4-17	...	9.7	17.6	11.1	20.1	18.0	....	....	....	....
VIII.	5-16	4.4	8.0	13.0	14.0	16.8	26.3	....	....	....	....
VIII.	2-17	5.9	7.5	13.7	13.7	15.0	19.1	....	....	....	....
XLV.	1-16-17	6.0	9.5	14.6	16.0	18.8	22.1	....	....	....	....
XLV.	1-23-17	....	....	....	15.0	17.8	19.5	....	....	....	....
LXXIII.	5-16	2.9	7.8	12.5	11.7	14.6	13.0	....	....	....	....
LXXIII.	1-17	2.5	6.7	10.9	10.7	12.8	14.7	....	....	....	....
CVIII.	9-16	0.0	3.5	7.0	8.0	16.5	21.0	19.2	20.3	25.0	20.0
CVIII.	1-17	....	....	....	....	....	....	18.0	25.0	33.3	40.0
CXXXI.	9-16	.8	5.0	6.4	13.0	15.0	16.7	....	....	....	....
CXXXI.	1-17	6.6	11.0	12.3	18.0	18.0	21.6	....	....	....	....

In Table III there are given the median scores for several adult groups to whom the tests were given. Generally these groups were teachers assembled in institute or students in education classes. These medians have no special significance aside from indicating the scores which may be expected of adults.

TABLE III.
Showing Median Scores for Adults

Test	Medians	Number tested
II.	34.6	54
I.	18.5	62
III.	35.0	64
III.	35.8	330
I.	23.0	65
II.	32.0	65
III.	40.4	65
—	36.8	36
—	34.8	37

Numerous criticisms have been made of the Kansas Silent Reading Tests. A number of these are probably valid and significant. Only a few of the criticisms reported to the Bureau of Educational Measurements and Standards have had to do

with insignificant details. The most frequent criticism has been concerning the character of the exercises. It has been pointed out that the exercises partake of the nature of puzzles, a very large number of them being arithmetical in nature. For this reason they are not typical reading material. This criticism is obvious to any one who examines the tests, and was very obvious to the author of the tests before they were published for distribution. The author attempted to eliminate this defect of the tests, but it was found impossible at that time. Granted that this criticism is valid, it remains to determine just how much it limits the significance of the scores obtained.

The above characteristic of the test was due largely to the fact that an effort was made to have the tests objective; that is, to have them of such a nature that a minimum of opinion would be exercised in marking the papers. This is a feature which is very important and which is not true of most of the reading tests which have been devised. The question might well be raised whether or not it was worth while to sacrifice other things to obtain this feature.

It has also been said that the ability measured by these tests was the ability to reason rather than to read; that in ordinary reading the mental processes involved were not those of reasoning, hence the scores obtained by means of these tests had no particular significance with reference to reading. The significance of this criticism of course depends upon what reading is. Certainly the exercises of these tests do have to do with the ability which occurs in some reading. It is probably true that a more satisfactory test could be devised by securing exercises which are more nearly like the ordinary reading material which the child meets in the elementary school.

A number who have used the tests have taken occasion to say that they found the tests very easy to administer and requiring only a small amount of time. In fact, no one has reported any difficulty in using the tests, or has even asked questions about giving them. This fact is significant, because teachers can not be expected to use tests which they do not understand or which require an unusual expenditure of time.

AN ANNOTATED BIBLIOGRAPHY OF RECENT LITERATURE ON THE BINET-SIMON SCALE (1913-1917)

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 "I find myself unable to concede to the point scale method a single one of the numerous advantages which have been claimed for it." Announces work on a new scale. Sees no reason why teachers may not use the scale or other standardized tests in order to better understand their pupils. "I think we must agree that a good deal which has been said *a propos* of psycho-clinical expertness (whatever that is) as a prerequisite for using the Binet scale is hollow buncombe."
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 Boston: Houghton, Mifflin Co., 1916, 362 p.p.
 This revision takes rank as the best that has yet been offered from the point of view of standardization and extension.
389. TERMAN, L. M., AND KNOLLIN, H. E.: *Some Problems Relating to the Detection of Borderline Cases of Mental Deficiency*.

- J. of Psycho-Asthen., 1915, 20: 1-15.
Indicated that the Stanford revision is more accurate than the Vineland revision in estimating dullness, borderlinity and feeble-mindedness.
390. TERMAN, L. M.; LYMAN, GRACE; ORDAHL, LOUISE; GALBREATH, NEVA; AND TALBERT, W.: *The Stanford Revision of the Binet-Simon Scale and Some Results from Its Application to 1000 Non-selected Children*.
J. of Educ. Psychol., 1916, 551-562.
Discuss tests upon 1000 non-selected children. Explain the basis and development of the revision. The intelligence quotient found a valid expression of intelligence. Practically no sex differences. Differences in social status not a disturbing influence in estimating mental age.
391. THORNDIKE, E. L.: *The Significance of the Binet Mental Ages*.
Psychol. Clinic., 1914, 8: 185-189.
Criticizes the gradation of tests in the Vineland revision of the scale, and indicates the true mental ages denoted by the scores obtained by that method.
392. THORNDIKE, E. L.: *Individual Differences and Their Causes*.
Proc. of a Confer. on Educ. Measurements. Indiana Univ. Bull., 1914, Vol. 12, No. 10, pp. 59-76.
A discussion of trends in education. "I foresee that a time is coming when Binet is a household word among teachers, just as Babcock is a household word among farmers."
393. THORNDIKE, E. L.: *Mental Tests to Inebriates*.
Archives of Psychol., No. 33, 1915.
394. THORNDIKE, E. L.: *The Significance of the Binet-Simon Tests*.
Psychol. Clinic, 1916, 10: 121-123.
Assuming that a construction test is a better instrument for measuring "general ability," than tests involving the use of language (completion and reading tests), it is found that the correlations between Binet age and "language" tests are higher than those between Binet age and a construction test. Therefore the Binet scale is inadequate.
395. TOWN, CLARA H.: *A Study of Speech Development in Two Hundred and Eighty-five Idiots and Imbeciles*.
J. of Psycho-Asthen., 1912, 17: 7-19.
(Discussion by G. Hudson Makuen.) (See next reference.)
396. TOWN, C. H.: *Language Development in Two Hundred and Eighty-five Idiots and Imbeciles*.
Psychol. Clinic, 1913, 6: 229-235.
Psychogenetic study of language development. (Language development at the mental age levels from one to six.)
397. TOWN, C. H.: *An Experimental Study of the Suggestibility of Twelve and Fifteen-Year-Old Boys*.
Psychol. Clinic, 1916, 10: 1-12.
Five tests used. The second suggestibility test is that incorporated in the scale. Draws conclusions regarding suggestibility in relation to age and repetition.
398. TOWN, C. H.: *Mentality Tests: A Symposium*. (See earlier reference.)
J. Educ. Psychol., 1916, 7: 351-353.
Finds the last Binet revision of the scale "of unequalled value in diagnosing and classifying defective children." The scale a dangerous tool in the hands

of the inexpert. Tests are required which measure "the controlled interplay of disparate mental processes," the ability to learn, and the ability to meet suggestion by a critical "survey of the situation."

399. TRABUE, M. R.: *Further Suggestions Regarding Mentality Tests*. (See earlier reference.)
J. Educ. Psychol., 1916, 7: 427-429.
Suggests that tests be employed whose results for different subjects "fall at practically equal intervals along a scientific scale for difficulty of performance." Need for tests measuring particular abilities is greater than for tests of general mental ability.
400. TRAVIS, A.: *Reproduction of Short Prose Passages: A Study of Two Binet Tests*. Psychol. Clinic, 1915, 9: 189-209.
Examined 128 students, 67 men and 59 women, at the Univ. of Pennsylvania. Concludes that these tests have no value for group application, and should therefore be eliminated as tests "for fifteen years and over, unless given under standard Binet conditions."
401. TREADWAY, W. L. *The Feeble-minded*.
Public Health Reports, 1916, 31: 3231-3247.
A survey of the school population in Arkansas, the scale serving as a basis for differentiation.
402. TREVES, Z., AND SAFFIOTTI, F. U.: *La "scala metrica dell'intelligenza" di Binet e Simon, studiata nelle scuole comunali elementari di Milano*.
Milano: G. Civelli, 1911, 67 p.
The application of the scale to the elementary school children of Milan, Italy.
403. TROVILLION, MAE C. *Deficient Children*.
Univ. of Indiana Master's Thesis, 1914, 75 p.
Applied scale to children in schools of Bloomington, Ind.
404. TUCKER, B. R.: *Nervous Children*.
Boston: Badger, 1916, 147 pp.
A discussion of the Binet scale.
405. UPTON, S. M. H.: *Open-air Schools*.
Teachers College Record, 1914, Vol. 15, No. 3, 60 pp.
The tests of the scale suggested as suitable for determining the progress of open-air school children.
406. VALENTINE, C. W.: *An Introduction to Experimental Psychology in Relation to Education*.
Baltimore: Warwick and York, 1916, 194 pp.
The Binet tests discussed.
407. VIDAL, A., AND ROBERTSON, C.: *La Inteligencia de los Escolares*.
Fourth Intern. Congr. on Sch. Hyg., Buffalo, 1913, Vol. III, pp. 564-568.
The use of the scale in connection with other series.
408. Virginia State Board of Charities and Corrections. *The Problem of the Feeble-minded*. Fifth Annual Report, 1913, pp. 8-24, Richmond, Va.:
Davis Bottom, 1914.
409. WADDLE, C. W., AND ROOT, W. T. JR.: *A Syllabus and Bibliography of Child Study with Special Reference to Applied Child Psychology*.
Bull. Los Angeles State Normal School, 1915, 98 pp.
Contains bibliography of mental tests.

410. WAITE, E. F.: *The Physical Bases of Crime from the Standpoint of the Judge of a Juvenile Court.*

Bull. Amer. Acad. of Medic. 14: 388, 395.

411. WALLIN, J. E. W.: *The Functions of the Psychological Clinic.*

Medical Record Reprint, Sept. 20, 1913, 14 pp.

"Almost everything that has been written about the Binet scale (until very recently) has been in the nature of praise—both judicious and extravagant, rather more of the latter. I think it is worth while, therefore, to call attention to some of the current misconceptions, and to sound a few warning notes, regarding psychological examinations."

412. WALLIN, J. E. W.: *The Mental Health of the School Child.*

New Haven: Yale Univ. Press, 1914, 463 pp.

413. WALLIN, J. E. W.: *The Hygiene of Eugenic Generation.*

Psychol. Clinic, 1914, 8: 121-137, 170-179.

Adversely criticizes studies in heredity based upon the reports of field-workers who used the scale for detecting feeble-mindedness. Cites cases indicating scale reactions.

414. WALLIN, J. E. W.: *An Analysis of Dr. Kuhlmann's Attack on "The Mental Health of the School Child."*

J. Psycho-Asthen., 1914, 19: 95-107.

A reply to Kuhlmann's criticisms. (See earlier reference.)

415. WALLIN, J. E. W.: *The Binet-Simon Tests in Relation to the Factors of Experience and Maturity.*

Psychol. Clinic., 1915, 8: 266-271.

Reviews some of the material in his "Experimental Studies of Mental Defectives" relating to these problems and indicates that native ability cannot be measured unmodified by environmental influences.

416. WALLIN, J. E. W.: *Psycho-educational Clinic and Special Schools.*

Sixty-first Annual report, pages 130-160, Bd. of Educ. of the City of St. Louis, Mo., 1915, 698 pp.

Of 430 cases recommended to the clinic for examination, 25.9% of the 320 boys and 40% of the 110 girls were found feeble-minded. There were almost twice as many backward and retarded as feeble-minded.

417. WALLIN, J. E. W.: *Who Is Feeble-minded?*

J. Crim. Law and Criminol., 1915-16 6: 706-716. Also,

Ungraded, 1916, 1: 105-113.

Based on the evidence presented by a number of definitely normal persons, it is maintained that adult individuals testing above ten years are unjustifiably called feeble-minded. (For reply to this article, see earlier reference.)

418. WALLIN, J. E. W.: *"Who Is Feeble-minded?" A Rebuttal.*

J. Crim. Law and Criminol., 1916, 7: 222-226.

A reply to article by Kohs. (See earlier reference.)

419. WALLIN, J. E. W.: *Criminal Irresponsibility.*

J. of Delinq., 1916, 1: 250-255.

"While we are in sympathy with the view that feeble-minded criminals should be treated as feeble-minded irresponsibles, we have not found it possible to accept the expanded interpretation which has been given the concept of feeble-mindedness." Namely, considering persons feeble-minded who yield a Binet scale reaction of 10, 11, or 12 years.

420. WALLIN, J. E. W.: *The Socio-Industrial Success of Feeble-minded Children Trained in Public Schools.*

Ungraded, 1916, 1: 142-143.

On the basis of 10, 11, or 12 year intelligence children should not be placed in special classes.

421. WALLIN, J. E. W.: *Mentality Tests: A Symposium.* (See earlier reference.)
J. Educ. Psychol., 1916, 7: 353-357.

"The Binet scale has fallen into considerable disrepute," not so much due to inherent defects of the scale, as to unfounded claims made for it, as well as its misuse by persons not properly qualified. During the period of mental growth the points of the point scale must be translated in terms of chronological age in order to be significant. Norms of performance should be based on the reactions of normal children only. Unselected groups inevitably include both normal and abnormal types. Makes the plea for tests and norms of psycho-motor capacity. Advises the endowment of a station for psychological tests and standards.

422. WALSH, ELIZABETH A.: *Ungraded Class Work in New York City—Methods and Results.*

J. Psycho-Asthen., 1914, 19: 59-66.

The use of the tests as an aid to class-room management.

423. WEIDENSALL, JEAN: *The Mentality of the Criminal Woman.*

Baltimore: Warwick and York, 1916, 332 pp.

The use of the scale in a comparative study of reformatory and working women.

424. WEIDENSALL, JEAN: *Criminology and Delinquency.*

Psychol. Bull., 1913, 10: 229-237.

Indicates tendency of conservatism in advising general use of the scale.

425. WENDER, LOUIS: *The Applicability of Binet-Simon Intelligence Tests in Psychoses of the Senium.*

N. Y. Med. J., Vol. CI, Mar. 6, 1915.

Intelligence and senility.

426. WHIPPLE, G. M.: *Stern, L. William: The Psychological Methods of Testing Intelligence.* (Educ. psychol. mon., no. 13.)

Baltimore: Warwick & York, 1914, 160 p.

427. WHIPPLE, G. M.: *The Use of Mental Tests in the School.*

5th Yrbk. Nat. Soc. for the Study of Educ., Part I, 1916, pp. 149-160.

A general summary indicating the great benefits for the educational system which makes use of the scale. A number of valuable suggestions.

428. WHIPPLE, G. M.: *Mentality Testing: A Symposium.* (See earlier reference.)

J. Educ. Psychol., 1916, 7: 357-360.

"The great need of the tester is that he shall come to 'feel' the conditions under which testing is reliable almost intuitively." Does not believe a standardizing bureau practicable. "The best methods will emerge on their own merits" because capable of "delivering the goods." Mentions need of scale to measure intellectual level of adolescents and outlines a method for use with college entrants. Points out neglect of tests "for the intensive and rather precise analysis" of specific abilities (psychogram).

429. WHITMAN, JOHN L.: *Jails, Lockups and Police Stations.*

J. Crim. Law and Criminol., 1915-6, 6: 240-248.

Outline of a program for a psychological research laboratory in a centralized system for unconvicted offenders.

430. WIERSMA, E. D.: *Intelligenzprüfungen nach Binet und Simon und ein Versuch zur Auffindung neuer Tests.*

Zsch. f. angew. Psychol., 1913-14, 8: 267-275.

Used the Binet-Bobertag 1911 revision, testing 141 Volksschule children, ages 6 to 12. Makes an analysis of his findings and suggests some new tests: concentration of attention, word building, dissected pictures, and picture recognition.

431. WILLIAMS, J. HAROLD: *The Problem of the Delinquent Boy.*

Child, 1915, 6: 29-32.

Examined 215 delinquent boys by means of the Stanford Revision of the scale. Found 32% feeble-minded.

432. WILLIAMS, J. H.: *Backward and Feeble-minded Children in Salt Lake City.*

Trg. School Bull., 1915, 12: 123-129.

A study of 108 backward school children. Estimates number of feeble-minded children in the schools at nearly 600. A few cases studies with Binet reactions.

433. WILLIAMS, J. H.: *Intelligence and Delinquency.*

J. Crim. Law and Criminol., 1915-16, 6: 696-705.

Preliminary report on the Whittier findings. (See later reference.)

434. WILLIAMS, J. H.: *Defective, Delinquent and Dependent Boys.*

Whittier State School (Cal.) Dept. of Research, Bull. 1, Dec., 1915, 16 pp.

The results obtained through the use of the scale discussed.

435. WILLIAMS, J. H.: *Classification of Fifty Backward and Feeble-minded School Children.*

Psychol. Clinic., 1915, 9: 97-106.

Application of the Stanford revision to selected children in four California cities. 32% were feeble-minded, 20% borderline, 22% dull normal, and 26% normal or superior.

436. WILLIAMS, J. H.: *A Study of 150 Delinquent Boys.*

Research Lab. of the Buckel Foundation, Stanford Univ., Bull. No. 1, 1915. 15 pp.

437. WILLIAMS, J. H.: *Delinquent Boys of Superior Intelligence.*

J. of Delinq., 1916, 1: 33-52.

A study of 20 delinquent boys possessing intelligences above the average for their ages (6½% of the total delinquent population in the Whittier State School). Individual cases discussed.

438. WILLIAMS, J. H., AND TERMAN, L. M.: *Psychological Survey of the Whittier State School* (47 pp.)

Bound in Biennial Report, Whittier State School, Whittier, Cal.: State School, 1914.

The findings based upon a mental examination of 150 inmates interpreted in the light of necessary changes in the administration of the school.

439. WINCH, W. H.: *Binet's Mental Tests. What They Are, and What We Can Do with Them.*

Child Study, 1914, 7: 1-5, 19-20, 39-45, 55-62, 87-90, 98-104, 116-122, 138-144. 1915, 8: 1-8, 21-27, 50-56, 86-92, (to be continued).

See reference 252 in earlier bibliography.

440. WINCH, W. H.: *The Detection on a Large Scale of Mental Deficiency in School Children.*
In Conference Report, National Assoc. for the Feeble-minded, London, June 25, 1915.
441. WITMER, LIGHTNER: *Congenital Aphasia and Feeble-mindedness—A Clinical Diagnosis.*
Psychol. Clinic, 1916, 10: 181-191.
The value and accuracy of the scale discussed.
442. WITMER, L.: *Clinical Records.*
Psychol. Clinic., 1915, 9: 1-17.
The qualitative evidence of a Binet examination is of far more significance than the quantitative. Since experienced examiners can pick out the feeble-minded on sight, why use the scale at all?
443. WITMER, L.: *The Relation of Intelligence to Efficiency.*
Psychol. Clinic, 1915, 9: 61-86.
Mental age "gives no clue as to the grade of a child's intelligence, although an experienced observer may estimate it from his behavior in solving some of the tests." The scale does not measure intelligence development. General intelligence cannot be tested. For the "differential diagnosis of intelligence" Witmer mentions twelve performance scales.
444. WOOLLEY, HELEN T.: *The Psychology of Sex.*
Psychol. Bull., 1914, 11: 353-379.
Reviews studies in general intelligence, measured by the scale, which throw light upon sex differences.
445. WOOLLEY, HELEN T.: *A New Scale of Mental and Physical Measurements for Adolescents, and Some of Its Uses.*
J. Educ. Psychol., 1915, 6: 521-550.
Presents scale for fourteen and fifteen year-olds.
446. WOOLLEY, HELEN T.: *Further Suggestions Regarding Mentality Tests.* (See earlier reference.)
J. Educ. Psychol., 1916, 7: 431-433.
Explains the work now being done at the Bureau of Vocational Guidance, Cincinnati, and indicates the value of test standardization for the construction of scales to measure both specific and general ability.
447. WOOLLEY, H. T.: *The Mind of a Boy.*
Survey, 1916, 37: 122-125.
Applied point scale to 18 year-old industrial workers. 25.5% were found feeble-minded. Advises change in the definition of feeble-mindedness, so that the tests should yield a proportion of mental deficiency more in harmony with the common sense opinion of legislators.
448. WOOLLEY, HELEN T., AND FISCHER, CHARLOTTE R.: *Mental and Physical Measurements of Working Children.*
Psychol. Monogr., 1914, 18, No. 1.
Pessimistic regarding tests beyond age 12.
449. YERKES, ROBERT M., AND BRIDGES, J. W.: *The Point Scale: A New Method for Measuring Mental Capacity.*
Boston Med. and Surg. J., 1914, 171: 857-66.

This scale is suggested "to take the place of the Binet measuring scale of intelligence and to furnish a more definite and accurate index of the mental capacity of individuals that can be obtained by the employment of the Binet method."

450. YERKES, R. M.; BRIDGES, JAMES W.; AND HARDWICK, ROSE S.: *A Point Scale for Measuring Mental Ability*.

Baltimore: Warwick & York, 1915, 218 pp.

Detailed procedure and general directions given, as well as basis for standardization.

451. YERKES, R. M., AND ANDERSON, HELEN M.: *The Importance of Social Status as Indicated by the Results of the Point-Scale Method of Measuring Mental Capacity*. J. Educ. Psychol., 1915, 6: 137-150.

Explanation of the point-scale. Finds a correlation between differences of social status and mental capacity.

452. YERKES, R. M.: *The Point Scale Method of Measuring Mental Ability*. (Paper read before Amer. Psychol. Assoc., 1914.)

Abstracted in Psychol. Bull., 1915, 12: 69.

Indicates the limitations of the Binet scale and the improvements made in the Point Scale.

453. YERKES, R. M.: *Educational and Psychological Aspects of Racial Well-Being*. J. of Proc. and Address. of the 54th meeting of the Nat. Educ. Assoc., New York, 1916, p. 248. Also, J. of Delinq., 1916, 1: 243-249.

"The so-called 'testing' of school children, now the fashion is a poor substitute for the kind of individual study that is needed. We must not imagine that the child is easily analyzed, measured, described. Only experts, highly trained, experienced in their special tasks, wise, are fit for the work. Incompetence is rife in the mental examining of school children, today, and unless harm is to result where good is experienced we shall have to look sharply to our methods and to the quality of our examiners." (Discussion by Helen C. Putnam.)

454. YERKES, R. M.: *Mental Examination of Police and Court Cases*.

J. Crim. Law and Criminol., 1916, 7: 366-372.

Cautions to be observed in diagnosis and treatment. Indicates what the examination ought to include.

455. YERKES, R. M.: *Mentality Tests: A Symposium*. (Letter quoted in discussion by C. E. Seashore. See earlier reference.)

J. Educ. Psychol., 1916, 7: 163-164.

"Age arrangement of tests is wrong in principle, violating the laws of mental development." Needs: three scales for measuring intelligence, supplemented by scales measuring mental functions. Announces the preparation of an adolescent-adult point scale for the measurement of intelligence. Advises ignoring the Binet method. Announces preparation of a book on "Psychological Examinations and Examiners: A Critique."

456. YERKES, R. M., AND WOOD, LOUISE. *Methods of Expressing Results of Measurements of Intelligence: Coefficient of Intelligence*.

J. Educ. Psychol., 1916, 7: 593-606.

An argument to prove the superiority of the coefficient of intelligence as an index of intellectual development.

457. YOUNG, M.: *The Mentally Defective Child*.

H. K. Lewis & Co., 1916, 140 pp.

One of the topics treated is the scale.

THE END

THE DERIVATION OF SIMPLER FORMS OF REGRESSION EQUATIONS

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As stated by Kelley on page 7 of his valuable bulletin on partial correlation and regression equations,¹ "The peculiar value of the regression equation is twofold: (1) It gives the mathematical means of combining any number of measures into a single measure in such a way that the highest possible correlation with a dependent measure is obtained. . . . (2) Further, the regression equation makes possible an analysis of the relative importance of the various contributory factors which bear upon a final result." (It is realized, of course, that by the latter statement is meant that the *most probable* relation of the importance of the various factors may be found. Except in rare instances, the possibility of the occurrence of which is theoretical, no absolutely true relations are found by regression equations.) Before the appearance of Kelley's *Tables* the labor involved in the solution of regression equations of more than three or four variables was almost prohibitive. It is estimated, however, that the *Tables* reduce the work eighty percent. It will be shown, moreover, that the equations may also be simplified. Thus, on page 8 of the bulletin is given the equation:

$$(1) \quad x_1 = b_{12 \cdot 3} x_2 + b_{13 \cdot 2} x_3$$

(x being the dependent variable.) Now an equation giving only the ratio of the coefficients of x_2 and x_3 is sufficient to serve the purposes mentioned above, provided accurate measures of the probable errors of the coefficients are not required, and is easier to solve.

Such an equation would be in the form:

$$(2) \quad \frac{x_1}{c} = \frac{b_{12 \cdot 3}}{b_{13 \cdot 2}} x_2 + x_3$$

Now

$$(3) \quad x_1 = r_{12 \cdot 3} \frac{\sigma_{1 \cdot 23}}{\sigma_{2 \cdot 13}} x_2 + r_{13 \cdot 2} \frac{\sigma_{1 \cdot 23}}{\sigma_{3 \cdot 12}} x_3$$

¹ TRUMAN L. KELLEY, *Tables: To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations*. Bulletin of the Univ. of Texas, 1916, No. 27. (See review.)

Dividing by the coefficient of x_3 , which let us call C_{x_3}

$$(4) \quad \frac{X_1}{C_{x_3}} = \frac{r_{12 \cdot 3}}{r_{13 \cdot 2}} \frac{\sigma_{3 \cdot 21}}{\sigma_2 \cdot 31} X_2 + X_3$$

$$(5) \quad = \frac{r_{12} - r_{13}r_{23}}{r_{13} - r_{12}r_{23}} \frac{\sqrt{1-r_{12}^2}}{\sqrt{1-r_{13}^2}} \frac{\sqrt{1-r_{23}^2}}{\sqrt{1-r_{12}^2}} \frac{\sigma_3}{\sigma_2} \frac{\sqrt{1-r_{13}^2}}{\sqrt{1-r_{23}^2}} \frac{\sqrt{1-r_{23 \cdot 1}^2}}{\sqrt{1-r_{23 \cdot 1}^2}} X_2 + X_3$$

$$(6) \quad \frac{X_1}{C_{x_3}} = \frac{r_{12} - r_{13}r_{23}}{r_{13} - r_{12}r_{23}} \frac{\sigma_3}{\sigma_2} X_2 + X_3$$

Thus it may be seen that it is possible to find the relative values of the coefficients of x_2 and x_3 without finding any coefficients of partial correlation. The number of arithmetic operations involved in the solution is reduced from 14 to 7.

It may be of interest here to note that the coefficient of x_2 in equation 6 is identical with the value of the weight, w , which will make the value of $r_{x_1}(wx_2 + x_3)$ a maximum, as found by calculus. Thus by the formula for the correlation of one variable with the sum of a number of others (see "formula a," p. 19 of the *Tables*),

$$r_{x_1}(wx_2 + x_3) = \frac{w r_{12} \sigma_1 \sigma_2 + r_{13} \sigma_1 \sigma_3}{\sqrt{w^2 \sigma_2^2 + \sigma_3^2 + 2w r_{23} \sigma_2 \sigma_3}}$$

Differentiating the right-hand member with respect to w , placing the differential equal to zero, and solving gives

$$w = \frac{r_{12} - r_{13}r_{23}}{r_{13} - r_{12}r_{23}} \frac{\sigma_3}{\sigma_2}$$

which may be seen to be the same as the coefficient of x_2 in equation 6.

Similarly it may be shown that the regression equation for four variables may be reduced as follows:

$$(7) \quad X_1 = r_{12 \cdot 24} \frac{\sigma_{1 \cdot 234}}{\sigma_{2 \cdot 134}} X_2 + r_{13 \cdot 24} \frac{\sigma_{1 \cdot 234}}{\sigma_{3 \cdot 124}} X_3 + r_{14 \cdot 23} \frac{\sigma_{1 \cdot 234}}{\sigma_{4 \cdot 123}} X_4$$

$$(8) \quad \frac{X_1}{C_{x_4}} = \frac{r_{12 \cdot 34}}{r_{14 \cdot 23}} \frac{\sigma_{4 \cdot 123}}{\sigma_{2 \cdot 134}} X_2 + \frac{r_{13 \cdot 24}}{r_{14 \cdot 23}} \frac{\sigma_{4 \cdot 123}}{\sigma_{3 \cdot 124}} X_3 + X_4$$

$$(9) \quad \frac{X_1}{C_{x_4}} = \frac{r_{12 \cdot 3} - r_{14 \cdot 3} r_{24 \cdot 3}}{r_{14 \cdot 3} - r_{12 \cdot 3} r_{24 \cdot 3}} \frac{\sigma_4 \sqrt{1-r_{24}^2}}{\sigma_2 \sqrt{1-r_{23}^2}} X_2 + \frac{r_{13 \cdot 2} - r_{1 \cdot 42} r_{34 \cdot 2}}{r_{1 \cdot 42} - r_{1 \cdot 23} r_{34 \cdot 2}} \frac{\sigma_4 \sqrt{1-r_{24}^2}}{\sigma_3 \sqrt{1-r_{23}^2}} X_3 + X_4$$

By this form of the equation the number of coefficients of partial correlation necessary to be found is reduced from 12 to 6, while the number of arithmetical operations remains the same, 18.

Similarly, again, it may be shown that the regression equation for five variables may be altered to read:

$$(10) \quad \frac{X_1}{C_{x_5}} = \frac{r_{12.34} - r_{15.34}r_{25.34}}{r_{15.34} - r_{12.34}r_{25.34}} \frac{\sigma_5 \sqrt{1-r_{45}^2} \sqrt{1-r_{25.4}^2}}{\sigma_2 \sqrt{1-r_{24}^2} \sqrt{1-r_{23.4}^2}} X_2 +$$

$$\frac{r_{13.24} - r_{15.24}r_{35.24}}{r_{15.24} - r_{13.24}r_{35.24}} \frac{\sigma_5 \sqrt{1-r_{45}^2} \sqrt{1-r_{25.4}^2}}{\sigma_3 \sqrt{1-r_{34}^2} \sqrt{1-r_{23.4}^2}} X_3 +$$

$$\frac{r_{14.23} - r_{15.23}r_{45.23}}{r_{15.23} - r_{14.23}r_{45.23}} \frac{\sigma_5 \sqrt{1-r_{35}^2} \sqrt{1-r_{25.3}^2}}{\sigma_4 \sqrt{1-r_{34}^2} \sqrt{1-r_{24.3}^2}} X_4 + X_5$$

By this form of the equation the number of coefficients of partial correlation necessary to be found is reduced from 32 to 21, but the number of necessary arithmetical operations increases from 28 to 33. In as much, however, as the finding of each coefficient of partial correlation requires a consultation of the tables and two arithmetical operations, the work of solving a regression equation of five variables is considerably reduced. It appears, however, that the relative amount of saving diminishes as the number of variable increases.

As an illustration of the use of a simplified regression equation we will show the solution of the equation involving four variables using the same coefficients of correlation which Kelley used in the illustration on page 12. The coefficients of partial correlation of the first order would be found in the usual manner, therefore we may use the values he has found. Substituting these and the values of sigma in equation 7 above,

$$\frac{x_1}{c_{x_4}} = \frac{.137 - .191 \times (-.199)}{.191 - .137 \times (-.199)} \frac{4.64}{3.13} \frac{.842}{.777} X_2 +$$

$$\frac{.032 - .207 \times .537}{.207 - .032 \times .537} \frac{4.64}{6.12} \frac{.978}{.777} X_3 + x_4 = 1.29X_2 - .400X_3 + x_4$$

Multiplying these coefficients by 5 instead of by 17.3 (both arbitrary) gives the same weightings, 6.5, -2, and 5, as Kelley found, for the three tests. The weightings, 8, 4, 2, and 1, given on page 17 can be found in the same way, using equation 10.

ABSTRACTS AND REVIEWS

TRUMAN LEE KELLEY. *Tables; To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations.* Bulletin of the University of Texas, May 10, 1916, No. 27.

The general purpose of these tables is clearly indicated in the title. One of the rather tedious formulas to be solved in connection with the calculation of partial coefficients is that of the form:

$$r_{12.3} = \frac{r_{12} - r_{13} \cdot r_{23}}{\sqrt{(1 - r_{13}^2)(1 - r_{23}^2)}}$$

(See G. Udny Yule, *Intro. to the Theory of Statistics*, p. 235, new edition p. 239.) Two such equations must be solved even in the simplest case of three variables. The fraction in the equation can be divided so that

$$r_{12.3} = r_{12} \left(\frac{1}{\sqrt{(1 - r_{13}^2)(1 - r_{23}^2)}} \right) - \left(\frac{r_{13} \cdot r_{23}}{\sqrt{(1 - r_{13}^2)(1 - r_{23}^2)}} \right)$$

Kelley puts A and B in place of these parentheses, letting

$$r_{12.3} = r_{12} A_{13,23} - B_{13,23}$$

$A_{13,23}$ and $B_{13,23}$ are therefore seen to be functions of r_{13} and r_{23} . The chief table given in the bulletin is that giving the values of A and B for all values of r_{13} and r_{23} to two decimal places. Other pertinent tables are also given.

The great convenience afforded by these tables in the calculation of partial coefficients of correlation will no doubt be more widely appreciated as the technique of such calculation becomes more extensively used. However, such technique is as yet probably unfamiliar to a large proportion of persons who have found a need for correlational mathematics, but who have not had much mathematical training. For this reason it is believed that in a second edition one or two examples of the simplest case of three variables should be worked out quite fully and applications shown. If necessary the case of five variables might be omitted, except to give the formula. The derivation of the values of A and B from the customary formula, as given above, would seem quite naturally to belong in the discussion. On the whole, the tables furnish a valuable contribution to the present group of mathematical appliances.

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EDITORIAL

The steady growth and extension of the scientific attitude toward the solution of educational problems should be most gratifying to all who are interested in the field which this journal represents. More and more frequently one finds evidences of this attitude in the discussions of educational gatherings, in the articles that appear in the non-technical educational journals, in the reports of school superintendents, and in the printed courses of study. Educational workers are rapidly developing a keen sensitiveness to the differences between fact and opinion and a readiness to discount opinion which is not backed up by factual evidence.

Perhaps the most striking change which the scientific attitude is bringing about is the development of a more rational attitude toward educational panaceas and cure-alls. The improbability that all of the problems of a complicated art can be solved by the application of a blanket dogma such as "interest," "mental discipline," "self activity," the "formal steps," "motivation," "correlation," and the

like, is readily recognized by one who has been trained to look facts in the face. And at the same time, there is a tolerant attitude toward innovations—a willingness to grant the possible virtues of this or that proposal, always subject to the verdict of controlled test. The scientific educator is usually ready to try almost anything once. There is less “cocksureness” than there was a decade ago, even among educational psychologists and statisticians. There is less “scolding” of teachers and school officers for their failure to know and act upon something that was discovered only the day before yesterday. The new blade has been tempered; it cuts far more keenly than it did before, but those who use it are much more careful not to spoil its edge.

There will be a vital need for this scientific attitude in the period of reconstruction that will immediately follow the war. There can

A PROGRAM NEEDED be no reasonable doubt that reconstruction throughout the world will center in education.

Both England and France have already projected plans for educational reform involving changes that would have been deemed utopian in 1914, while from Germany there come persistent rumors of a transformation of educational ideals that may be even more sweeping in its scope and consequences. Certainly if the war has proved anything it has proved that, under modern conditions, the strength of nations varies directly with the attention that they give to universal education.

All of this means that educational reform will be the focus of constructive efforts to build up a new world order, and the scientific attitude and the scientific temper must guide and control these efforts if the largest permanent good is to be accomplished. It is none too early to prepare for this period of reconstruction. The amateur educational statesman will be ready with his nostrums; but those who have studied educational problems long and seriously should have something much more fundamental and thoroughgoing—a penetrating program, the virtues of which as compared with the snap-shot superficialities of the amateur will be apparent at once to the public.

W. C. B.

NOTES AND NEWS

The twenty-sixth annual meeting of the American Psychological Association was held in affiliation with the American Association for the Advancement of Science at Pittsburgh, December 27-29. Among the papers on the program the following were of interest to educational psychologists: "The Forgetting Curve as Affected by Conditions of Learning," E. C. Tolman; "The Mentality of Oriental and American College Students," K. T. Waugh; "Norms of Irregularity on Point and Stanford Scales," S. L. Pressey; "The Stanford Revision as Applied to College Students," H. H. Caldwell; "Substitution and Direction Tests Correlated with Class Standing," R. H. Gault; "The Use of Mental Tests in Selecting Pupils for a Gifted Class," G. M. Whipple; "A Standardized Opposites Scale," E. E. Jones; "Elements in Reading Abilities," D. Starch; "Determinants of Error in Spelling," L. S. Hollingworth; "The Learning Curves of the Analogies, Mirror Reading, and Alphabet Tests," F. A. C. Perrin; "Objective Measurement of Relative Size of Units in a Judgment Scale," S. A. Courtis; "Spelling Ability and Vocabularies of 200 College Students," E. Murray. The presidential address by Major Robert M. Yerkes was on the topic "Psychology in Relation to the War."

The program of the seventeenth meeting of the Central Association of Science and Mathematics Teachers, held at Columbus, Ohio, November 30 and December 1, contained papers of interest to scientific students of education, as follows: "The Present State of General Science as to Content and Method," Fred D. Barber; "A Study of the Attainments of High School Pupils in First Year Chemistry," J. Carleton Bell; "Measurement of the Products of Teaching High School Mathematics," S. A. Courtis; "The Place of Demonstrations in the Physics Classroom," R. O. Austin; "Some Suggestions in Measuring Results in Physics Teaching," Franklin T. Jones.

At the meeting of the New York Branch of the American Psychological Association, November 26, 1917, the following papers were presented: "Psychological Examinations of College Freshmen," Edith Carothers; "Distribution of Time in Learning Vocabularies," Robert A. Cummins; "When Does the Baby Begin to Think," G. C. Myers; "A New Clinical Test for the Temperature Sense," E. L. Cornell; "A Psychological Test of Expertness in Marksmanship," A. I. Gates.

At the meeting of the Kansas History Teachers' Association, on November 8, 1917, Professor David Snedden, of Teachers College, Columbia University, spoke upon "Needed Readjustments in History Teaching," urging a radical reorganization of the history course.—*School and Society*.

Professor Bird T. Baldwin, director of the child welfare research station of the University of Iowa, has been appointed research lecturer to the colleges of the state for the current year. It is the duty of the research lecturer to deliver at each of the colleges of the state a lecture illustrating some phase of his own scientific investigations with the purpose of stimulating interest in and enthusiasm for graduate study and original investigation. Professor Baldwin's theme will be "What is a Normal Child?"

Dr. J. Mace Andress, head of the department of psychology and child study at the Boston Normal School, is giving a course of twenty lectures at the Tuckermann School on "The Study of the Learning Process, Habit, and the Higher Mental Processes in Education."

At Swarthmore College the work in psychology and education formerly conducted by Professor Bird T. Baldwin will be carried on jointly by Professor Charles Fisher, of the department of education, West Chester State Normal School, and Professor S. B. Davis, of the department of education of Ursinus College.

Mr. Arthur S. Otis, formerly of Leland Stanford University, more recently assistant psychologist at the Vineland Training School for Feeble-Minded, is now doing war work in the office of the surgeon general at Washington.

Dr. Josiah Morse, professor of philosophy and sociology at the University of South Carolina, has been granted leave of absence for the duration of the war to become director of the Red Cross work in South Carolina and field director of the work at Camp Jackson.—*School and Society*.

Dr. Thaddeus L. Bolton, who has been psychological clinician in the public school system of Hartford, Conn., for the past two years, has been appointed professor of psychology in Temple University, Philadelphia.

Dr. H. H. Meeker has been made head of the department of education of Marshall College, taking the place of Miss Anna Cummings, resigned.

H. G. Wheat, formerly superintendent of schools of Williamstown, W. Va., has been appointed head of the department of education of the Glenville Normal School.

H. W. Anderson, of Iowa City, Iowa, has been appointed director of research in the Omaha, Nebraska, public schools.

T. H. Garth, Ph. D. (Columbia), has been elected head of the department of education in West Texas State Normal College.

Carl Rosenow (Ph. D., Chicago, '17) and Jacob Kantor (Ph. D., Chicago, '17) have been appointed instructors in the department of psychology of the University of Chicago.

PUBLICATIONS RECEIVED

WILLIAM H. ELSON AND SARAH A. HASTE. *Elson's Spelling Book*. Chicago: B. D. Berry Company, 1917. Pp. ix, 282.

This speller is constructed on lines of recent scientific investigation. It rests on the following general principles, which every psychologist can accept: (1) that spelling has to do with the writing vocabulary rather than with the general or reading vocabulary; (2) that we write only words the meaning and use of which we know; (3) that only needed words should be taught and the more difficult of these should be repeated and stressed; (4) that minimum test lists should be established for the various grades. The words are carefully divided into lessons for each day, with review lessons at the end of the week. Each advance lesson consists of nine words, six new and three repeated from the grade below. The book is intended to be used from the third grade to the eighth inclusive. The material for each half year ends with a list for a semi-annual contest, and each year presents a minimum list based on Ayres' spelling scale. The entire Ayres scale is given in the appendix. This is the first spelling book to give adequate weight to recent studies of spelling, and as such deserves the careful attention of superintendents and teachers.

JANE FALES. *Dressmaking. A Manual for Schools and Colleges*. New York: Charles Scribner's Sons, 1917. Pp. xiii, 508.

There is a growing recognition of the fact that dressmaking, cooking, carpentry, and metal working may be even more educative than Latin, algebra, or logic. One handicap under which the more concrete subjects have suffered is the lack of adequate, scholarly and comprehensive text-books. They have been treated too exclusively from the narrow, utilitarian point of view, and broader educative values have been ignored. The present volume is a distinct step in the direction of remedying this defect. Part One sketches the historic development of costume, part two discusses the manufacture of textiles and textile economics, and part three presents the technical details of dressmaking. If any college professor imagines that this subject does not demand intelligence or does not contribute mental training, let him carefully peruse this book and honestly estimate how much effort he would have to put forth to satisfactorily complete the course there outlined. There is an extensive bibliography on the history of costume and on textiles, but one is struck by the limited number of references on dressmaking itself. Dressmakers have undoubtedly been more active with the needle than with the pen.

HENRY FAIRFIELD OSBORN. *The Origin and Evolution of Life*. New York: Charles Scribner's Sons, 1917. Pp. xxxi, 322. \$3.00.

This is one of the most important of recent books for a general philosophy of life. Presenting as it does the ripe thought of one of the world's greatest experimental zoologists and paleontologists, it stimulates the imagination and opens new vistas to the serious reader who is trying to understand himself in relation to his environment. Taking for granted the main outlines of the doctrine of evolution, the author pushes the argument farther back and presses the inquiry into the causes of evolution. "The first half of the volume is devoted to what we know of the capture, storage, release, and reproduction of energy in its simplest and most elementary living phases; the second half is devoted to the evolution of matter and form in plants and animals, also interpreted largely in terms of energy and mechanics." In carrying out this plan the author sketches the probable conditions of earth, air and water before there were any manifestations of life, the various forms of physical energy derived from the sun, inorganic and primitive organic chemical processes, describes the evolution of bacteria, algae and higher plants, and contrasts plant evolution with animal evolution. Then follows an account of the evolution of protozoa, of metazoa, the story of the fossil invertebrates, and then in turn the development of the fishes, the amphibians, the reptiles, the birds, and the mammals. The evolution of man is reserved for more extended treatment in a subsequent volume. While there is necessarily frequent use of terms from the vocabulary of geology and zoology, the discussion is popular rather than technical in its nature, and is directed to the person of average education. The work is profusely illustrated with material drawn largely from the splendid collections of the American Museum of Natural History, of which the author is president, and there is a bibliography of fourteen pages. It is a contribution to the popularization of natural philosophy of which Americans may well be proud.

ELLEN SCHMIDT. *A Dramatic Reader. Book Three*. Chicago: B. D. Berry Company, 1916. Pp. ix, 239.

Among the good old stories that are dramatized in this little book are "The Blind Men and the Elephant," "Three Men of Gotham," "Snowwhite," "Hercules, the Lion Killer," "Loki and the Gifts," "Cinderella," "The Brahmin and the Tiger," and "The Ugly Duckling." The dramatizations will add greatly to the zest with which these stories are interpreted by young pupils.

The World Book. Organized Knowledge in Story and Picture. Edited by M. V. O'Shea, Ellsworth D. Foster, and George H. Locke, assisted by one hundred and fifty distinguished scientists, educators, artists and leaders of thought in the United States and

Canada. Chicago: Hanson-Roach-Fowler Company, 1917. To be complete in eight volumes. Vol. I, A-Blight, pp. 768. Vol. II, Blindness-Crow, pp. 769-1648.

This is a unique undertaking "to select out of the world's knowledge all that is most interesting, illuminating and useful, and present it in an orderly manner so that it may be comprehended, enjoyed and utilized alike by young and old." The efforts of the editors have been crowned with remarkable success. Written in simple, untechnical language, and richly illustrated, the volumes appeal even to children of the lower grades, and are an invaluable resource to the high school pupil. The various phases of school work, as addition, arithmetic, algebra, astronomy, bookkeeping, botany, chemistry, receive several pages each and contain many useful suggestions for parents and teachers. Perhaps the geographical terms are treated most fully and interestingly of all. Abyssinia, for example, has almost four pages, with two groups of illustrations. There is an account of the physical features of the country, the people and their occupations, cities and communication, government, and history, with a study outline and a list of questions to fix the important facts that one should know about the country. Africa has thirteen pages with six excellent maps, Alaska fourteen pages, Alberta eleven pages, and so on. Another class of terms that receive brief but satisfactory treatment are the names of historical, political and literary personages. These range from Aeschylus to King Albert of the Belgians, and are dealt with in just such fashion as would satisfy the needs of the ordinary reader. All information about current topics has been brought up to date, and much attention is paid to the geographical, political and economic changes which have been or are likely to be brought about by the War of Nations. In brief it is no exaggeration to say that this work far surpasses anything else of the sort in attractiveness, usefulness, and recency of information.





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